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. . THE TRANSACTIONS . .

OF THE

THIRD ANNUAL MEETING

OF THE

ASSOCIATION OF MILITARY SURGEONS,

OF THE

National Guard of the United States.

HELD AT RUSH MEDICAL COLLEGE

ON AUGUST 8TH,

AND AT

UNITED STATES GOVERNMENT BUILDING, JACKSON PARK,
(WORLD'S COLUMBIAN EXPOSITION),

AUGUST 9TH AND 10TH, 1893.

CHICAGO, ILLINOIS.

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CHICAGO, ILLS.

FIRST DAY—MORNING SESSION.

The Association convened in the upper amphitheater of Rush Medical College, and was called to order by the President, Col. Nicholas Senn, Surgeon General Illinois National Guard, at 10 o'clock a. m. Prayer was offered by Rev. Bishop Samuel Fallows, D. D., of Chicago.

President Senn introduced the Hon. Carter H. Harrison, Mayor of Chicago, who delivered an address of welcome to the City of Chicago.

Col. Senn, in introducing Mr. Harrison, said:

The citizens of Chicago recognize the fact that this was an important year and took early prophylactic measures to place in the executive chair of the city government a gentleman who should fitly

represent the city during this significant epoch. They looked for a man the master of not only ten languages, but one who could converse with different nationalities in their native tongue. They looked for a man who could address a woman's congress, a congress of different educational interests, a congress of children, and who could successfully welcome a convention of silverites. When the spring election came party lines were ignored, and Carter Harrison was elected by an overwhelming majority. One of the reasons for changing the place of meeting of this association was to give the most popular mayor of the United States an opportunity to address the most representative, and certainly the most learned military organization of the United States. I now take great pleasure in introducing to you his Honor, Carter H. Harrison, Mayor of the City of Chicago. (Loud applause.)

Mayor Harrison was enthusiastically received. He spoke as follows:

Gentlemen of the Association of Military Surgeons of the National Guard of the United States: It is said that in modern times that one of the most important means of establishing peace in this world between husband and wife, neighbor and neighbor, politicians and voters, and the people generally, is taffy. (Laughter.) Your president has a large amount of it. He gave taffy to you and taffy to me, but he forgot the reverend gentleman, Bishop Fallows, who has just preceded me. I am asked to talk on a subject of which I know comparatively nothing, and to men whom I do not know. Bishop Fallows has talked to you about the Lord, with whom he is intimate. He has talked to you as one who knew him.

Your President says I am invited here because it gives me an opportunity to speak to you, but there is another reason far deeper, and one that none of you have even dreamed of. It is one that connects me with this building. When the Rush medical people built this college they built it wiser than you are. The Presbyterian Hospital erected its building, and they built it much wiser than you are. This block used to be my property, and I lived here when all around us was prairie, and across the road, where the Dental College of Surgery now stands, was my town lot. That is not much, but I used to dodge the law in those times. I was not a mayor then, and I did what you would do, took advantage of mayors when I could. (Laughter and applause.) I was bucolic in my nature, having been bred upon a farm. Well, I had my cow lot right here, and my horse lot over where the other college is located; in other words, I am the builder

and forerunner of the medical profession in Chicago. (Applause.) I believe in doctors. I have such confidence in them that I can trust them away from me, except in case of absolute necessity. But I did something that none of you dreamed of, and that is, I helped to build this college. In those days I tried to circumvent mayors, and it was necessary when a man had a cow or a horse die to pay $5.00 to cart it off. Now it costs $37,000 a year to cart dead animals away beyond the city limits and get rid of them. I wanted to save my $5.00, and when my cow died I buried it right under Rush Medical College where it now stands. They had a temporary Rush Medical College here, and the circumstances attending the digging of the foundation were watched with great interest. In digging the foundation they found the bones of my cow, and even to this day there is not a student of medicine who can say whether the bones belonged to a cow or a woman. They have been studying bonology ever since. (Laughter and applause.)

I am very glad to have the opportunity of welcoming you here, and I do so with a great deal of pleasure. I once said that gambling was "an inevitable misfortune," but the papers quoted me as saying it was "an inevitable necessity." All of the papers in Chicago but one are given to lying. *The Times* never lies. I have taught it not to. I discharged a reporter twice for lying. In this country we hate wars. We pray for universal peace, and in our feeling of better manhood we pray with earnestness. When our savage nature gets up and the animal crops out, then like animals we are pugnacious; we are too easily moved. It is our pride that we have a little standing army for the whole of the United States, although it is not one quarter as large as some armies. Here we have a government by the people, and are not ruled by any one man. We are governed by men who rule by the will of the people. Our people do not want standing armies, they want protection. They want every man to be a soldier, ready when necessity calls him to go, or where necessity demands that he should go as a good citizen. We are all soldiers, and we are all liable to be called in, and the great National Guard of this country is to be its protection. The regular army is simply a nucleus around which the mighty army is to grow. It makes a man brave, and makes him rush to the front when he knows that bullets and bayonets may meet him, and, furthermore, that there are medical men to cure his wounds, and to nurse him in his illness. An organization like this is calculated to educate the great surgeons not only of the regular army, but the volunteers or militia, and goes far to make every man feel

that he can have a good nurse and a good doctor even on the tented field, as good as though he were in his quiet bed at home. (Applause.) Your association is calculated to do a vast amount of good. Many heads are vastly more beneficial than one head in the matter of organization, and this seems to be the day and age for your organization. All bodies of men are organizing, and carrying out the idea that "In union there is strength." Chicago is now the sixth city in the world in population, and the second in America. It is not egotism for the Chicagoans to say that the time is not far distant when it will be the second city in the world, and we will vie with London for the position of being first. London draws her food from every quarter of the earth. Her bread comes from Russia, India and America; her wool comes from Australia and South America; her meat from Australia, the Argentine Republic and the United States; her vegetables from countries in Europe and elsewhere. Macauley drew no wild picture when he spoke of the New Zealander standing upon London bridge and looking over the ruins of St. Paul, He drew no wild picture when he told us what America might suffer with a redundancy of population. It is with no small degree of dread that I to-day look upon the hard times that are around us. There are 200,000 people in the City of Chicago, roughly speaking, unemployed, who know scarcely where to get to-morrow's meal. Cosmopolitan as we are, we are not yet bound together by a common bond. With the largest city but three in the world, with the third German city on the face of the globe, with the second Bohemian city on earth, with our manifold interests, Chicago may yet have dangers to face equal to the Haymarket riot. Your President alluded to my making a speech to the silverites, and I will say that if the Congress of the United States does not give us money to relieve this distress, we will have riots that will shake this country from one end to the other.

Gentlemen, allow me to welcome you to the city of Chicago. I hope that your visit will be pleasant and profitable, and that you will some day meet here again. (Applause.)

Dr. Truman W. Miller, Major and Surgeon Illinois National Guard (retired) was next introduced and delivered an address of welcome on behalf of the local Medical Profession:

Mr. President and Gentlemen of this Association: It is extremely difficult for me to express by words the heartfelt welcome which the medical profession of this city has given me the pleasant duty of extending to you at this meeting.

We welcome you to the birthplace of this Association and wish to assure you that none of the privileges to which you are entitled, by the right of heritage, have been forgotten or allowed to wane by your temporary absence.

We expect you to feel it your duty to assume your rightful place among your brethren here, knowing that our hearthstone is yours, and it will be our pleasure to keep it well warmed for you so long as you remain with us.

Our citizens, with their well-known hospitality, join with us in hearty greeting and welcome you to our city, its institutions and their homes, trusting that they may contribute so much to your entertainment and interests that you will bear away with you pleasant memories only of your visit here.

We esteem it an honor that you have selected this city for the third annual meeting of this Association, and believe in so doing you have acted for its best interest.

Aside from presenting you with active scientific work in our institutions, which we believe are second to none in the land, we have to show you, in our glorious White City, conceived by the wizard's brain and built by the touch of the magician's wand, exhibits from all nations of the latest appliances, methods and preparations known or used for the advancement of medical and surgical science, and it is with great professional pride that we invite your attention to the exhibits made by this government through the officers of the army, navy and marine hospital service, together with those of our universities, feeling that you will be convinced that we are rapidly progressing in scientific investigations.

Foreign nations have also contributed liberally in demonstrations of rare professional interest which you can not fail to appreciate as they represent the history of medical science, and especially its latest developments.

If, as army surgeons, you desire to examine various implements of warfare, by which nations have dealt death and destruction to their foes, you will find exhibits from the barbaric period down to the time of our own exquisite civilization, and perhaps you may feel that science has achieved more by its methods of warfare towards the destruction of the human race than it has to its relief.

I refer to a few matters of professional interest only which this great Exposition affords, but can assure you that once within its portals you will bow in respect to the welcome extended to you by the combined genius of the world.

Your presence here, as members of this Association, to take an active part in extending its work and influene gives hope of a continuance of the marked progress it has already made.

Medical men have always been expected to give a large part of their services for the relief of the human race without a full recognition of their value, but we believe that a well established association of military surgeons will command respect and a position in military organizations which can be attained by no other means.

In every State an effort should be made to elevate the standard of its medical staff.

The ranking medical officer can, by his personal influence, succeed in demonstrating to each member of his corps the advantages to be gained by a membership in the National Association.

A foundation has been laid for the building up of one of the most prominent and necessary departments of the military organizations of this country, and it remains with you to foster and perpetuate it.

Trusting that in your visit to this city you may fully realize your expectations of its pleasures, I will conclude by again extending to you our warmest welcome.

Major Albert H. Briggs, of the National Guard, State of New York, was next called upon, and in the absence of Col. Louis W. Read, of National Guard, Pennsylvania, responded on behalf of the Association:

Mr. President and Gentlemen: No one regrets more than myself the absence of Col. Read, to whom was assigned the duty of replying to these cordial words of welcome. For he would express our thanks in fitting and eloquent terms, while I, relying on the inspiration of the moment, must of necessity leave much unsaid. The eloquent address of His Honor, Mayor Harrison, extending to us the hospitality of this great city, and the kind words of welcome from the brethren of our own chosen profession, as voiced by Major Miller, suggest many things to my mind as fitting to say, but as the morning hour is far spent and many things remain undone which must claim our attention, I will be brief. Permit me, therefore, in behalf of my associates of the Association of Military Surgeons, to extend our heartfelt thanks for the hospitable greeting so gracefully extended to us. I am confident that when our work is finished and we have scattered to our homes we will carry away and cherish none but pleasant memories of our visit to Chicago.

The report of Capt. Charles Adams, Assistant Surgeon Illinois National Guard, Chairman Committee of Arrangements, was next in order and submitted as follows:

ENTERTAINMENTS.

TUESDAY.

A cold collation will be served at mid-day, in the hospital adjacent to Rush Medical College.

A reception will be held at the residence of Col. and Mrs. Senn, 532 Dearborn avenue, from 8 to 11 p. m.

WEDNESDAY.

A theater party will be given by the members of the Illinois National Guard to the members of the Association and their friends, at the Auditorium, at 8 p. m.—"America."

THURSDAY.

Electric illumination at the World's Fair Grounds, from 8 to 10 p. m.

Through the courtesy of Captain Louis A. LeGarde, U. S. A., the members of the Association are cordially invited to inspect the Medical Section of the Government Exhibit at the Columbian Exposition "which will be found principally in the Army Hospital, which is an eighteen-bed structure, built in accordance with the plans and specifications furnished by the Surgeon-General of the United States Army. The plan is one of the recognized ones for a Post Hospital, and in the arrangement of the Ward, Dispensary, Storeroom, Offices, etc., it differs but little from the hospital of a Permanent Army Post.

The ward is not fitted up for patients, however, as it is not intended to treat patients here. The space in the ward is to be devoted: (1) to the display of two hospital beds, to show the pattern of bunk and the bedding in use in army hospitals; (2) models to show the evolution in hospital construction in the Medical Department of the Army; (3) models of hospital steam vessel and hospital cars; (4) a number of wet and dry preparations illustrating pathological lessons of various kinds; (5) about 300 Bromide enlargements and transparencies, illustrating the various histological and pathological tissues of the body; (6) a series of 80 consecutive sections of bone, illustrating the form and structure of osseous tissues; (7) ten series of consecutive sections of human embryos, illustrating the anatomy of various portions of the body; (8) a collection of microscopes, illustrating the

evolution of the instrument; (9) a collection of deformed leaden bullets, gathered from cases during the War of the Rebellion; (10) a collection of specimens showing bony lesions of gunshot injuries from the same sources; (11) a collection of specimens showing the difference in destructive effect of bones between the leaden projectile of the .45-calibre Springfield Rifle and the German silver mantle projectile of .30-calibre Experimental Springfield Rifle.

The Dispensary contains a full outfit of drugs, dressings, etc., and the Storeroom contains supplies for 100 men for one year. The Post-Surgeon's office contains a collection of medical books and periodicals as per standard Supply Table of the Medical Department.

Two of the rooms upstairs are to be used as office and reception room, and the space in the other two rooms is to be devoted to the uses of a Clinical and Bacteriological laboratory.

In this department will be seen a number of thermostats in operation, a collection of such cultures as particularly interest the general practitioner, the method of preparing media of various kinds, methods of staining bacteria in and out of tissues, the drying of blood on cover slips, and the staining of the same by the the Biondi Ehrlich method, to show the difference between the anæmias and lukæmias, the methods of hardening tissues and the cutting of sections by the microtome, as well as the more common methods of staining and mounting sections for examination under the microscope. For the intelligent supervision of this department the services of Dr. W. M. Gray, of the Army Medical Museum, Dr. Meade Bolton, and possibly Dr. Thayer, of the John Hopkins Hospital have been secured.

In two framed hospital tents, near the hospital, will be exhibited models showing the evolution in the transportation of sick and wounded in time of war.

There will be exhibited, under canvas also, a field hospital of 24 beds; it is proposed to place this exhibit in the encampment, as the field equipment of the Medical Department can only be effectually shown with troops in the field. It is proposed as one of the chief features in this display to have a contingent of the Hospital Corps from Fort Riley for the purpose of illustrating the ambulance service, litter drills, the methods of rendering First Aid to the wounded, etc."

Report accepted.

Col. Nelson H. Henry, First Vice President, Assistant Surgeon-General National Guard, State of New York, then assumed the chair and introduced President Senn, who deliv-

ered an address on "Enterorrhaphy, its History, Technique and Present Status:"

ENTERORRHAPHY.

ITS HISTORY, TECHNIQUE AND PRESENT STATUS.

Col. Nicholas Senn, Surgeon-General Ills. N. G., Chicago.

A study of surgical literature brings the conviction that the successful treatment by direct operative intervention of injuries and surgical affections of the intestinal tract is one of the most brilliant achievements of modern surgery. Less than fifty years ago many of the most famous surgeons regarded the direct treatment of wounds of the intestines as a *noli me tangere*, under the belief that nature's resources would prove more successful in saving the life of the patient than the surgeon's efforts in closing the wound by artificial means. The intentional infliction of an intestinal wound by the surgeon for the purpose of correcting mechanical difficulties anywhere in the intestinal canal and the removal of life-threatening affections by operative procedure are subjects which have been seriously discussed and extensively practiced only during the last twenty-five years. It is advisable and profitable during the present time that has witnessed such wonderful advancements in surgery to make occasionally a halt in the restless search for new discoveries and novel operations to take a retrospective view of what has been done in the past in certain departments of surgery that have recently been subjected to such complete revolutionary changes. No part of abdominal surgery has undergone more radical changes than the intestinal suture, and in none is the contrast greater between the ancient and modern methods. I have deemed it advisable on this occasion to give you, in place of a general address, as brief a resume as possible of the history, technique and present status of enterorrhaphy.

HISTORY AND TECHNIQUE.

The history of the intestinal suture is full of interest to the student of surgical literature. It is replete with stupendous ignorance, clever mechanical ingenuity, patient experimental research, and the careful application of pathological knowledge to the treatment of injuries and diseases of the intestinal canal. From an anatomico-practical standpoint the history of the intestinal suture can be divided into three epochs: 1, ancient; 2, modern; 3, recent. The ancient history extends back from Lembert (1826) to the time of Celsus. The modern history commenced with the researches of Lembert, which

proved that healing of intestinal wounds takes place most constantly and speedily if the serous surfaces are brought and kept in contact by the sutures. The third period was initiated by the introduction of the aseptic suture by Lister, and will necessarily extend far into the future. We have reason to believe that the technique of intestinal suturing remains an unfinished chapter, and that the ideal method of uniting intestinal wounds has yet to be devised.

I—ANCIENT METHODS.

Celsus mentions the intestinal suture, but speaks disparagingly of its use. It is probably on this account that the subject did not receive any attention until Abulkasem (II, 87) again revived it. This author recommended the jaws of large ants with which to unite the wound, and also refers to catgut made of the intestine of the sheep as a suturing material. The oldest suture, and the one to which nearly all of the old authors refer, is undoubtedly the glover's suture. This suture was intended to approximate the cut margins of the intestinal wound in the same manner as any ordinary wound, and was used for the double purpose of preventing the escape of intestinal contents, and of keeping the visceral in close contact with the external wound, consequently the two ends of the suture were brought out of the external wound and fastened in some way upon the surface of the abdomen until the time had expired when it was deemed safe to remove the thread.

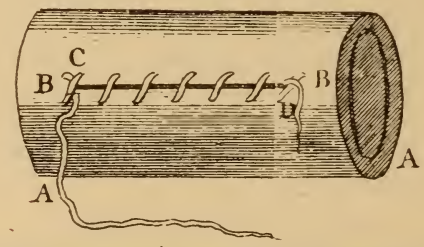


Fig. 1. Glover's suture used for uniting wounds of the intestines. AA, the intestine; BB, the wound; C, the beginning of the suture, with part of the thread hanging out; D, the end of the suture, where it is fastened in a knot.

Figure 1 is taken from Heister's Textbook of Surgery, translated by Hollingsworth, 1739, and represents the glover's suture as applied by the ancient surgeons. Roger, Jamerius, and Theodorich of Servia inserted into the bowl a hollow cylinder of elder over which the wound was united by sutures. The cylinder was used for the purpose of keeping the lumen of the intestine patent. Wilhelmus v. Saliceto (Cerlata, Chir. Venet., 1520, page 107) used a segment of the dried

intestine of an animal with the same object in view. Later, he agreed with his colleagues that the best material to assist the suturing would be the dried trachea of a goose or some larger animal, and thus originated the suture of the four masters. The foreign substance was not fastened in the bowel; after its insertion into the lumen the margins of the wound were united by ordinary interrupted sutures, which embraced the entire thickness of the intestinal wall and the ends of which were left long and were brought out of the external wound. The

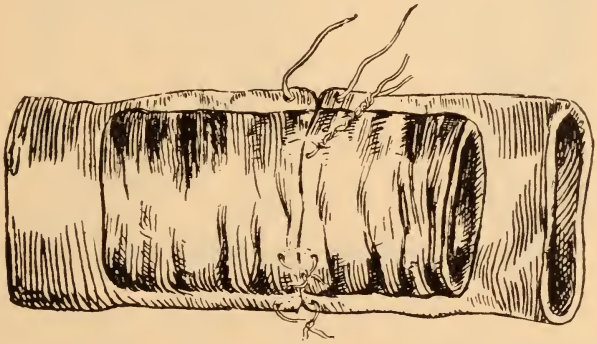


Fig. 2. Suture of the four masters.

process of the ancients, however, had attracted so little attention that Du Verger, who revived it at the beginning of the last century, considered himself its author. It would not appear moreover, that it had been frequently made trial of, or that it proved successful more than two or three times.

Du Verger modified the suture of the four masters by including the tracheal cylinder in the sutures as is shown in Fig. 3. Sabatier

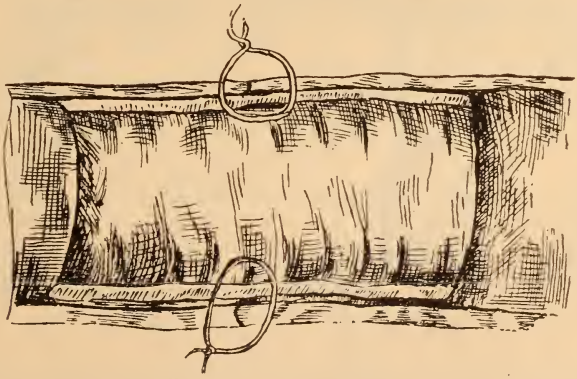


Fig. 3. Suture of Du Verger. Sutures including the tracheal cylinder.

substituted for the trachea a cylinder of cardboard which he besmeared with sweet oil, essence of turpentine, or oil of St. Johnswort.

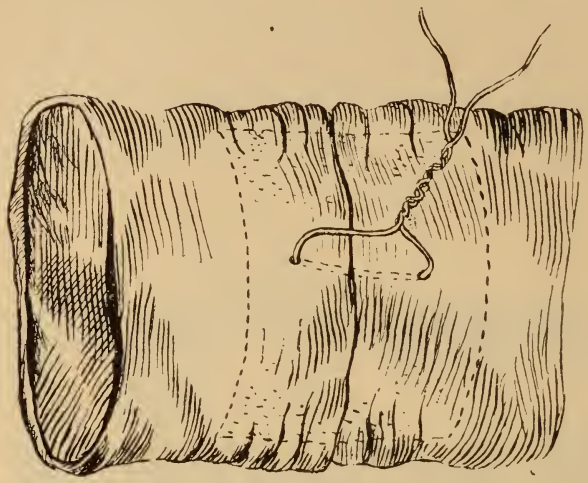


Fig. 4. Suture of Sebatier.

Sebatier used only one stitch in fastening together the two ends of the bowel and the cardboard cylinder, as will be seen by the

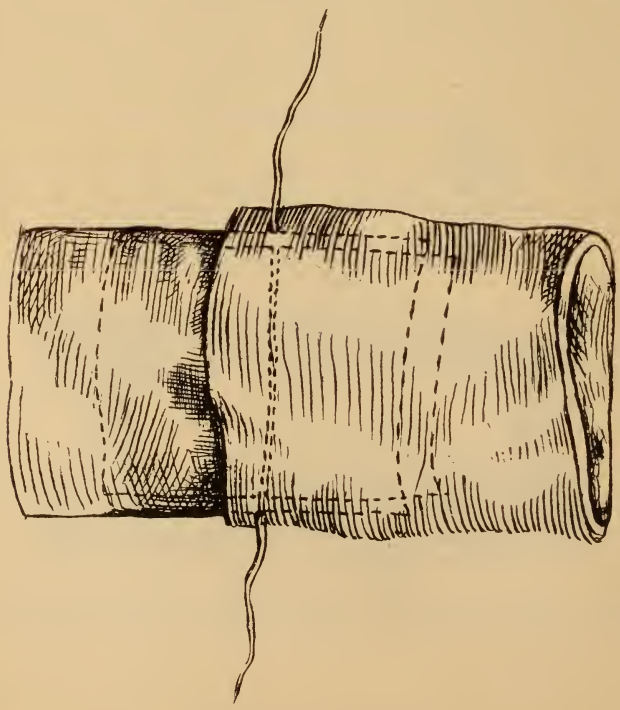


Fig. 5. Suture of Ritsch.

accompanying illustration. The four masters used four stitches, Du Verger two, Sebatier one; when Ritsch ("Transactions of the Academy of Surgery," Paris, vol. i) modified the procedure still further by passing the thread from side to side through the center of the bowel and the cylinder, when the ends were twisted and brought out of the external wound.

Watson ("Medical Communications," Vol. ii) recommended a cylinder of fish glue. His experiment on a dog proved successful. Ph. von Walther advised a tube of India rubber.

It is not surprising that the methods of suturing heretofore described did not add to the reputation of intestinal surgery, and that many of the most prominent surgeons of that time opposed closure of intestinal wounds by artificial means.

Guy de Chauliac approved of the suture only in the treatment of wounds of the large intestine, for which he recommended the glover's suture. Vigo, Fallopius and Fabricius ab Aquapendente regarded wounds of the small intestines as absolutely fatal.

Hyeronimus Braunschweig (Das Buch der Cirurgia, Strassburg, 1497) alludes to Galen and others as opposing the intestinal suture. He is in favor of the procedure and advises the glover's stitch in preference to the ordinary suture. After suturing the intestine he cleansed the part and applied a powder of equal parts of mastich, tragacanth, and gum arabic. He relates a remarkable case which occurred in the practice of Saliceto, one of the four masters. A cavalier of Papia (Pavia) stabbed himself in the abdomen with a knife in such a manner that the intestines prolapsed. A longitudinal wound of the intestine was found. Master Ottebanus of Papia was called, who pronounced the injury a fatal one. Owing to the swelling of the protruded intestines he failed in effecting reduction. Saliceto was called in consultation who cleansed the intestines, sutured the wound, enlarged the abdominal opening, reduced the mass and saved the would-be suicide.

In 1686 Richard Wiseman ("Chirurgical Treatises," second edition, London, 1686, P. 372), the great English surgeon, writes on this subject as follows:

"If in such a penetrating wound the small guts be wounded, the vehement pain, continual vomiting of choler, and dejection of chyle by the wound, will discover it; but in that case, the keeping of it open to seek the intestine will be a hard task; and when you have found it, what will it signify, to embrocate all the region of the belly with ol. mastrich lumbric, to dress the wound with sarcotics, and to keep it close and warm with compress and bandage. But if the great intestines be wounded, and the excrements discharge that way, it may be reasonable to lay open the wound and stitch the gut with the glover's

stitch, sprinkling it with some of the aforesaid agglutinatives; and reducing it back, stitch up the external wound of the belly, as hath been said."

It appears that more than fifty years later the consensus of opinion among surgeons in reference to the utility of the direct treatment of intestinal wounds had not undergone any material change if we rely on another eminent authority of that time. Heister, in his classical work on Surgery (Hollingsworth's Translation, 1739) cautions not to suture intestinal wounds smaller in diameter than a goose quill, after which he continues:

"But large wounds of the intestines, though they seldom admit of cure, are to be stitched up with the glover's suture before the intestine is returned. To perform this, you should be provided with a fine needle, threaded with silk; an assistant should take hold of one part of the gut, with a fine piece of linen well aired before the fire, whilst the surgeon should hold the other part in his left hand and sew up the whole wound after the glover's manner, leaving very small spaces between each stitch, to wit—a little more than a mathematical line. The last stitch should hang out about a foot out of the abdomen, by which the silk may be drawn out when the intestine is healed."

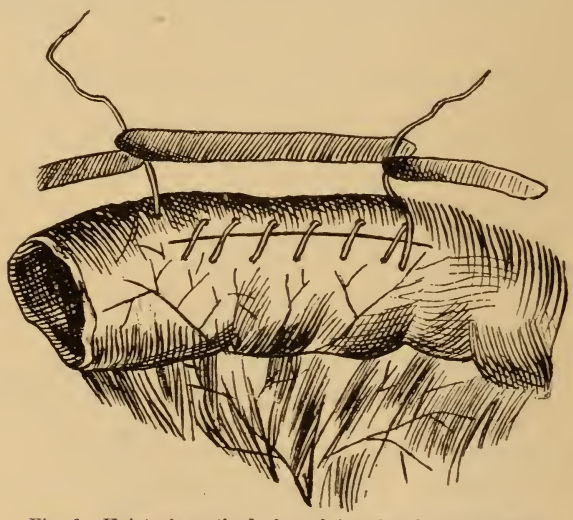


Fig. 6. Heister's method of applying the glover's suture.

After alluding to several other kinds of sutures, he gives his estimate of the value of suturing intestinal wounds; "but, to say the truth, experience shows us that very few are saved, whatever suture is made use of." In complete transverse wounds he advises the formation of an artificial anus.

Purmann (Feldscherer, etc., Frankfurth u. Leipzig, 1730) in his military surgery recommends suturing with silk or catgut, using the

continued or glover's stitch. The catgut, prepared from the intestines of sheep, he immerses in wine over night before using it. He also refers to the shoemaker's stitch, but in his own practice always resorted to the glover's suture. In the after-treatment he advises mild cathartics and turpentine injections.

Mr. Samuel Sharp ("A Treatise on the Operations of Surgery," etc., London, 1769) gives the following directions in the use of the glover's suture:

"Upon the supposition of the intestine being wounded in such a manner as to require the operation, the method of doing it may be this: Taking a straight needle with a small threat, you lay hold of the bowel with your left hand and sew up the wound by the glover's stitch, that is, by passing the needle through the lips of the wound, from within outwards all the way, so as to leave a length of thread at both ends, which are to hang out of the incision of the abdomen, then carefully making the interrupted suture of the external wound, you pull the bowel by the small threads into contact with the peritonæum, in order to procure an adhesion, and tie them upon a small bolster of linen; though I think it would be more secure to pass the the threads with the straight needle through the lower edges of the wound of the abdomen, which would more certainly hold the intestine in that situation. In about six days, it is said, the ligature of the intestine will be loose enough to be cut and drawn away, which must be done without great force; in the interim, the wound is to be treated with superficial dressings and the patient to be kept very still and low."

During the close of the first decade of this century Zang (Darstellung blutiger heil künstlericher Operationen, etc., Wien, 1818) entertained the most extreme pessimistic views in reference to the value of the intestinal suture as is evident from the following sentence: "Every intestinal suture is a mighty procedure in a highly vulnerable organ, and therefore a dangerous, yes, a very dangerous undertaking." As the most convincing proof of its harmful action, he claimed that the mortality following its use was much greater than when the process of repair is left to nature's resources.

The bad results which followed suturing of intestinal wounds in the hands of the ancient surgeons as well as the observation made that occasionally cases recovered without any aid on the part of the attending surgeon, led the way to the most conservative treatment. It was generally conceded that spontaneous recovery occurred when the visceral wound was in such a locality that no extravasation occurred into the peritoneal cavity, and the wound became adherent to a serous surface, notably the parietal peritoneum. Spontaneous recovery from complete transverse wounds of the intestine by adhesion of the margins of the proximal end to the external wound

was observed by Hildanus, Blegny, Dionis, Palfyn, Joh. Maur, Hoffmann, Seebacher, Vater, Cheselden and others. This induced surgeons to imitate nature's processes by bringing the intestinal wound or the ends of the divided bowel into the external wound, in which position the wounded intestine was fastened by passing a thread through the mesentery and fastening it upon the surface of the abdomen. This operation was first performed successfully on a dog by Blegny (Zodiac, Gall. Aug. 2, p. 143.) Schacher (Programmate Publico, Leipzig, 1720) reported the first successful operation of this kind on man. Verduc and von de Wyl were opposed to the intestinal suture and advised the formation of an artificial anus, especially in cases of transverse wounds.

It is probable that Paracelsus was the first to propose this method of treatment. Palfyn rejected all kinds of intestinal sutures and advised that in all wounds of the intestine easily accessible, the visceral wound should be brought in close contact with the external wound and the intestine held in this position by a thread passed through the mesentery until the intestine became firmly adherent to the abdominal wall.

Palfyn's method of fixation of the intestine against the abdominal wall is illustrated by Fig. 7.

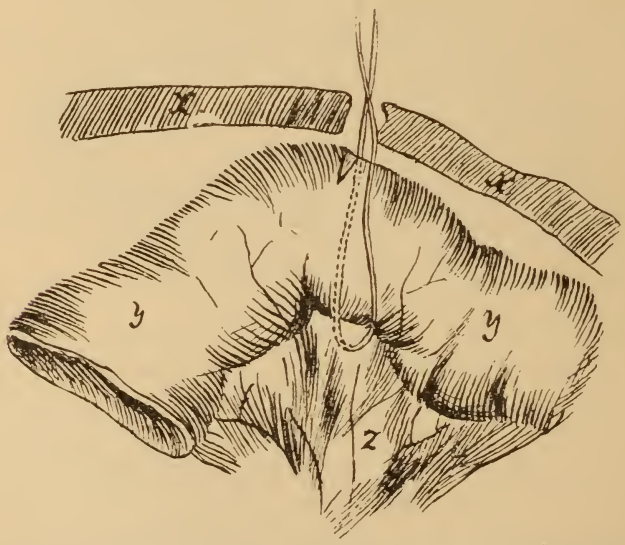


Fig. 7. Palfyn's method of treating intestinal wounds. *a*, Thread passed through mesentery and surrounding the bowel. *y*, Intestine. *z*, Mesentery. *x*, Abdominal wall.

As the traction by the mesenteric ligature must have caused narrowing of the bowel, Palfyn's method was modified so as to obviate this difficulty by passing the needle and thread twice through the mesentery and bringing both ends of the thread out through the external wound on each side of the bowel, as is shown by Fig. 8.

Fig. 8. Modification of Palfyn's mesenteric loop.

De la Peyronie's ("Mem. de l' Academ. de Chirurgie," T. III, 1733) method differed somewhat from Palfyn's, in that he stitched the bowel at the same time to the margin of the external wound. Other surgeons dispensed with the mesenteric loop entirely and fastened the injured part of the bowel to the inner surface of the abdominal wall by a suture which embraced both lips of the visceral and parietal wounds.

In complete transverse wounds of the intestine Benj. Bell recommended that each end of the bowel should be fastened to the corresponding margin of the external wound by an interrupted suture.

Reybard ("Mémoires sur le traitement des anus artificiels, des plaies des intestines et des plaies pénetrantes de poitrine," Paris. 1827) maintained that the principal object of the intestinal suture is to bring the visceral wound in contact with the inner surface of the abdominal wall and the external wound, thus securing healing of both wounds by adhesions, and acting on this supposition he devised an

exceedingly ingenious plan in accomplishing this result without the use of sutures. In longitudinal and incomplete transverse wounds he

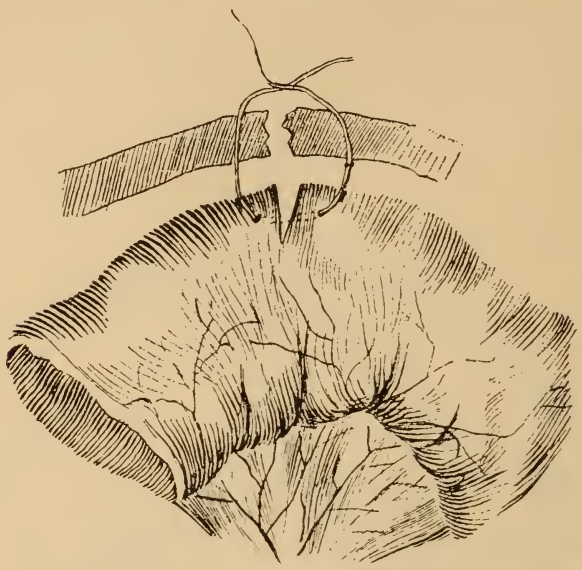


Fig. 9. Fixation of injured bowel to abdominal wall by a single suture.

resorted to the uses of a thin oiled plate of light wood, twelve to fifteen lines in length, and four to six in breadth, to which two pieces of thread were attached.

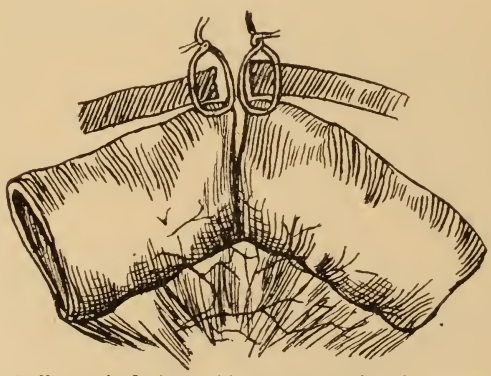


Fig. 10. B. Bell's method of attaching the visceral to the parietal wound.

Each thread is armed with a needle when the plate is inserted into the bowel through the wound, and the needle with the thread attached is passed through the entire thickness of the abdominal wall and brought out on the surface near the margin of the external wound.

When both threads are in place they are tied together in such a manner that the small plate of wood presses at the same time the two lips of the intestinal wound against the sides of the abdominal wound, which latter it also at the same time keeps hermetically closed. When the adhesion of these different tissues appears to have become sufficiently firm (usually the third day) the threads are cut; the little plate of wood is released and passes away with the stools.

There can be no question that the intentional foundation of an artificial anus in the treatment of intestinal wounds, so strongly advocated by Scarpa ("An. Chir. Abh. über die Brüche," Leipzig, 1892, p. 280; translated by Seiler from the Italian), and many of his contemporaries, yielded much better results as a life-saving measure than the old-fashioned suture. We have reason, however, to believe that in many instances in which life was saved the artificial anus remained permanently, constituting a great annoyance, and often an additional source of danger throughout the balance of the lifetime of the survivor. The great mortality attending this procedure and this remote sequence undoubtedly aroused surgeons to devise new methods of suturing. So firmly had the opinion gained ground that intestinal wounds could not

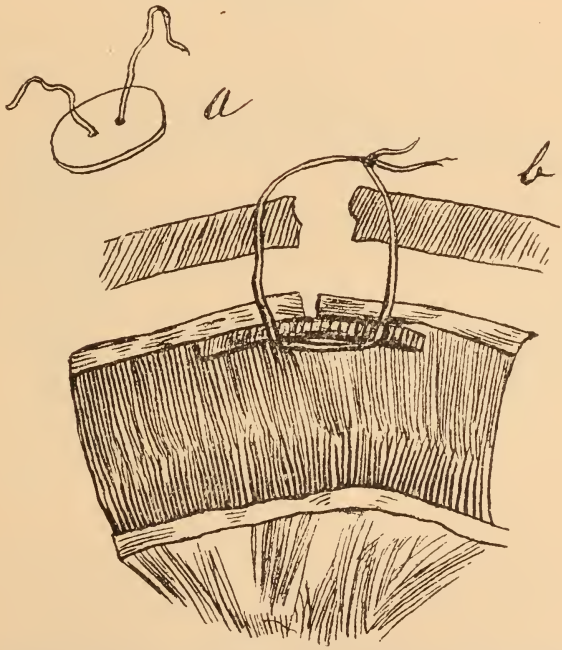


Fig. 11. Reybard's method. *a*, Plate of wood with two threads; *b*, plate *in situ* and fastened to abdominal wall by a suture including plate wall as bowel and abdominal wall

heal by direct union that v. Walther (System der Chirurgie, Freiburg, 1851), as late as 1851, asserted that healing always takes place by parietal or omental adhesions. He insists that Larrey was wrong when he asserted the contrary and excuses his mistake by asserting

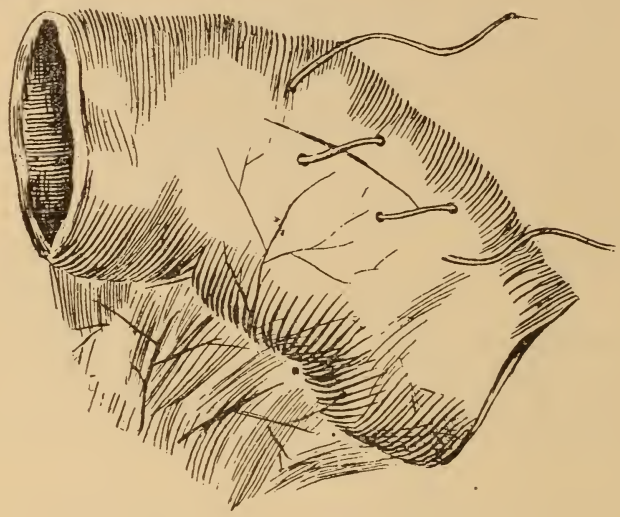


Fig. 11 *a*. Suture after Garengeot.

that when he made his observations he did not have the necessary material to enable him to arrive at correct conclusions. The next class of sutures to be described resembles the old-fashioned glover's suture in so far that the different sutures were intended to prevent the escape of intestinal contents, and at the same time by leaving the threads long they could be utilized in anchoring the visceral against the ventral wound.

Garengeot modified the ordinary glover's suture only in so far that he placed the stitches farther apart.

Larrey ("Revue Médicale, 1820, iv, p. 77) regarded a single row of the continued suture as unsafe and advised in its place two rows, using for each row threads of a different color, and making the stitches in opposite directions. He recommended removal of the two threads at the end of seven or nine days.

Benj. Bell feared the removal of the suture and objected to the ordinary glover's suture because he believed it produced dangerous narrowing of the lumen of the bowel. He modified the glover's suture in such a manner that he passed the needle from within outward terminating the thread at each end with a knot and cutting the thread short

to the knots. He relied on the suture cutting its way into the lumen of the bowel to be discharged with the feces.

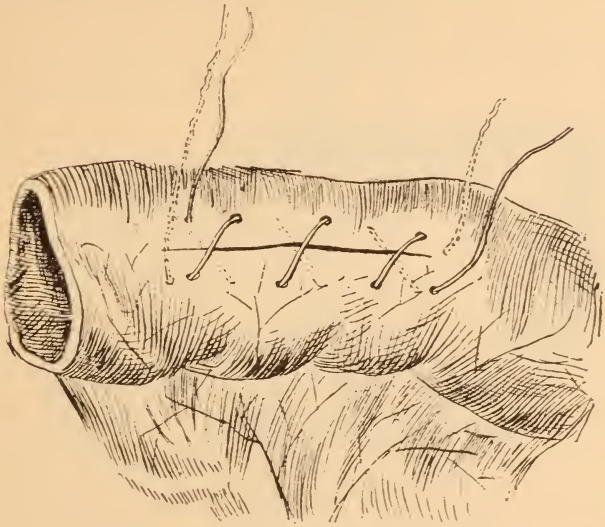


Fig. 12. Larrey's double the glover's suture.

Bertrandi and Petit devised the *sutura transgressiva*. It is made by bringing the margins of the wound in contact. passing the needle

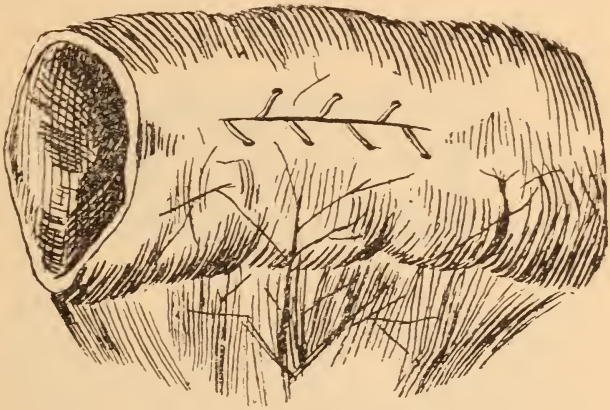


Fig. 13. B. Bell's suture.

from right to left, then from left to right alternately and bringing both ends of the thread out of the external wound in order to bring both wounds in contact.

Le Dran ("Traité des Opérat.," Paris. 1743) takes as many threaded needles as stitches are required, and passes them three lines

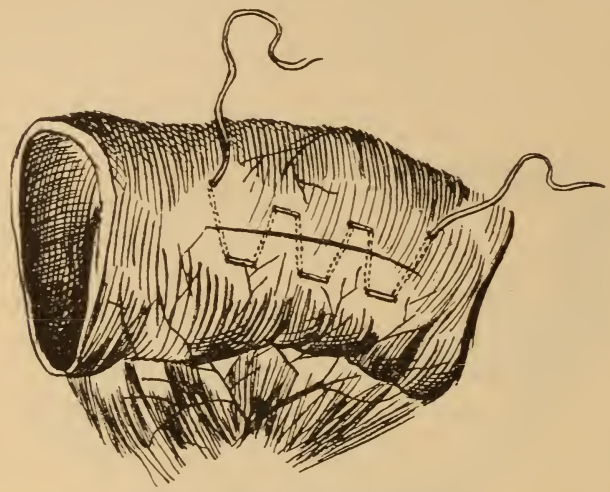


Fig. 14. Petit's sutura transgressiva.

apart through both margins of the wound. Ties together the ends of the threads of each side and twists the two bundles of threads. The intestine is thereby puckered up and sutures approximated.

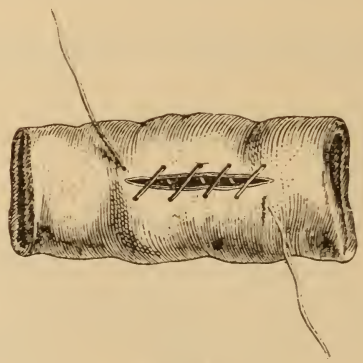


Figure 14 *a*.

He claims that by this procedure the intestinal wound is greatly diminished in size, and often heals without leaving a fistula; at the end of four to six days the threads are untwisted and removed. Richter twisted each suture separately without tying it and brought them out of the external wound with which to fasten the bowel against the abdominal wall.

Löffler crossed the threads of each suture only once and fastened the ends upon the surface of the abdomen.

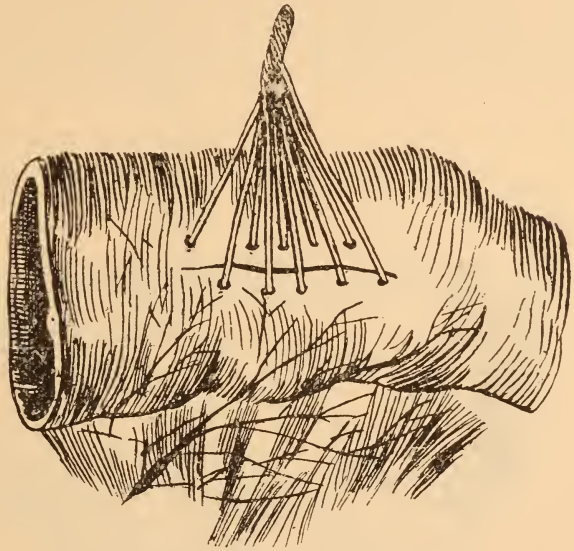


Fig. 15. La Dran's method.

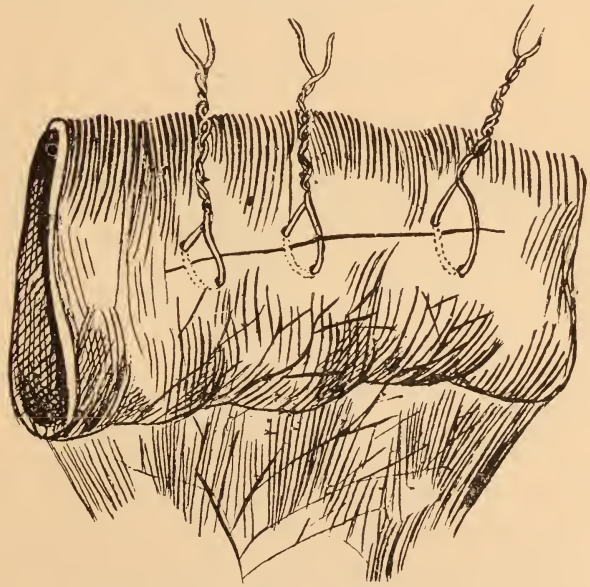


Fig. 16. Richter's method.

With the exception of the suture devised by B. Bell, all of the modifications of the glover's suture were intended to anchor the visceral wound opposite or in the external wound and were removed as soon as the intestine had become firmly adherent, that is, in the course of four to seven days. In many of the cases in which life was saved

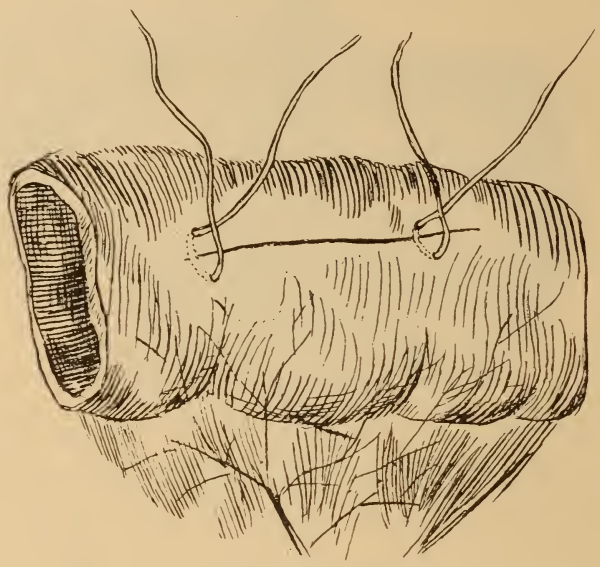


Fig. 17. Löffler's method.

by this kind of surgery a fistulous opening remained, which in those days it was found difficult to remedy. With a view of preventing this unpleasant remote complication surgeons commenced to unite the ends of the bowel in complete transverse wounds by invagination. The first trials were extremely crude, and the results correspondingly disastrous. Ramdohr recommended invagination as a means of uniting the ends of the intestine in complete transverse wounds as early as 1730. Having under treatment a soldier in whom the continuity of the intestinal tube had been destroyed, he proposed to insert the upper into the lower end, to fasten them together in this position by means of one point of suture, then to reduce them and leave them in the abdomen, fastening the bowel to the abdominal wall by the suture. His patient recovered. As he died some years after of some other affection, Ramdohr being thus enabled to examine the condition of the parts, removed the portion which had been formerly divided and sent it to Mœbius, who took occasion to show it to

Heister, which latter upon the strength of this made experiments of the same operation on dogs, but without success.

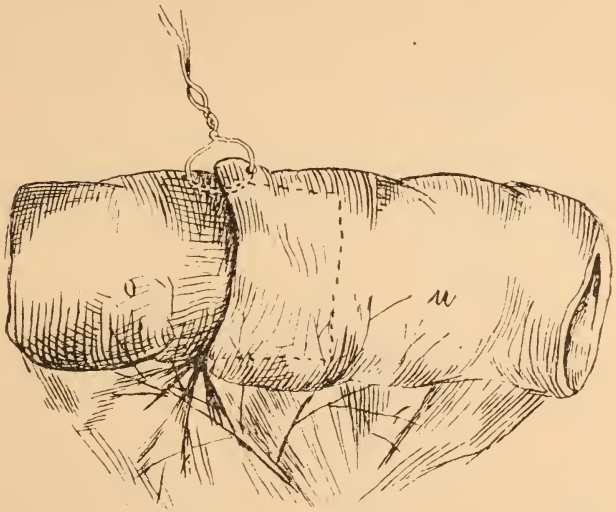


Fig. 18. Ramdohr's method of invagination. O, upper end. U, lower end.

The method of Ramdohr, which has been eulogized by some, rejected as impossible or dangerous by others, admitted, as very in-

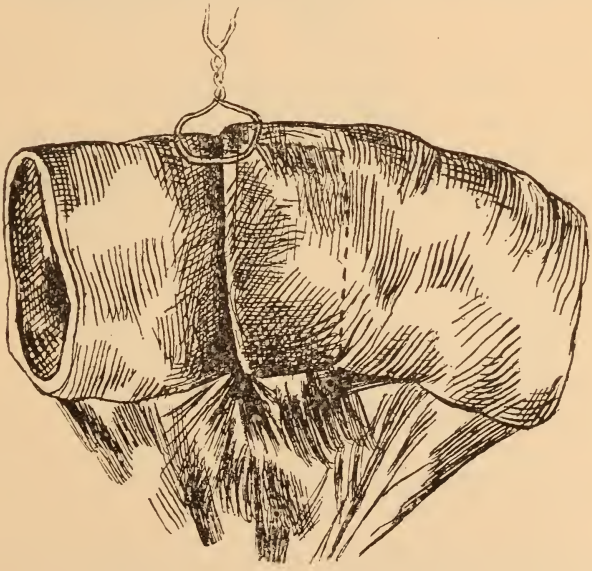


Fig. 19. Method of invagination of Louis.

genious by Louis, and made trial of in a great number of instances since it has been known, does not appear to have succeeded but in a very small number of cases. Louis aimed to improve Ramdohr's method by detaching the mesentery from the upper end to the extent of the intended invagination for the purpose of guarding more effectually against disinvagination.

Benj. Bell inserted a solid cylinder of tallow into the upper end of the bowel before making the invagination, and fastened the bowl with two rows of interrupted sutures which included the entire thickness of both intestinal walls at each cut end of the bowel.

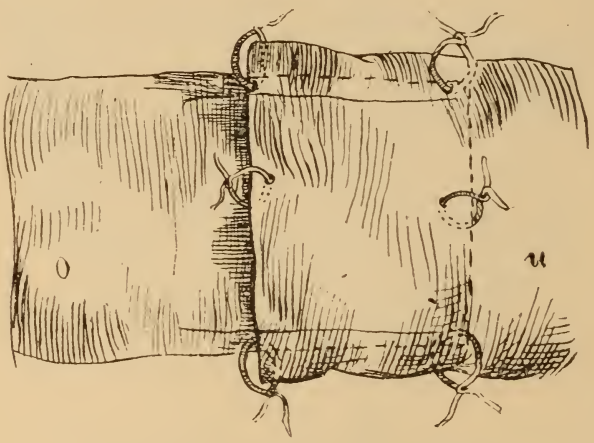


Fig. 20. Benj. Bell's method of invagination.

Chopart and Desault, recognizing the difficulties encountered in making the invagination, lined the upper end of the bowel with a cylinder of cardboard which was included in a single ligature passed through the bowel from side to side, when both ends of the thread were passed with a needle in the lower end from within outward, when the invagination was effected by making traction upon the threads and the invagination maintained by fastening the threads upon the surface of the abdomen.

These authors applied the same principle of treatment to incomplete transverse wounds of the intestine. The upper margin of the wound was transfixed by a single suture transversely from within outward, when the ends were passed with a needle through the lower margin from within outward and tied, making this the lower margin overlap the upper, bringing in contact its mucous surface with the peritoneal surface of the upper.

As all these methods had the common fault of approximating mucous membrane with peritoneum, it is not difficult to understand

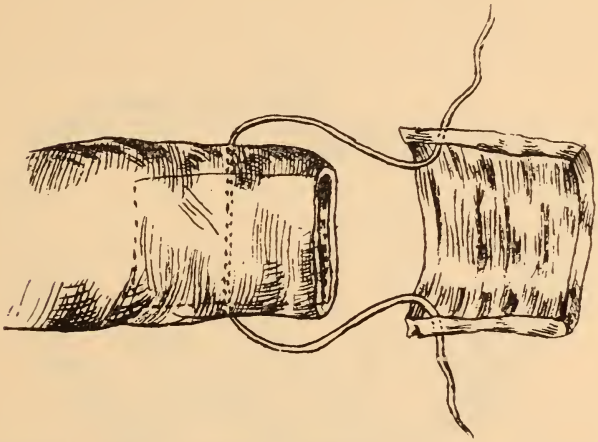


Fig. 21. Chopart and Desault's method of invagination in complete transverse wounds.

that none of them survived the practical test for any length of time. The seriousness of this technical mistake was first pointed out by

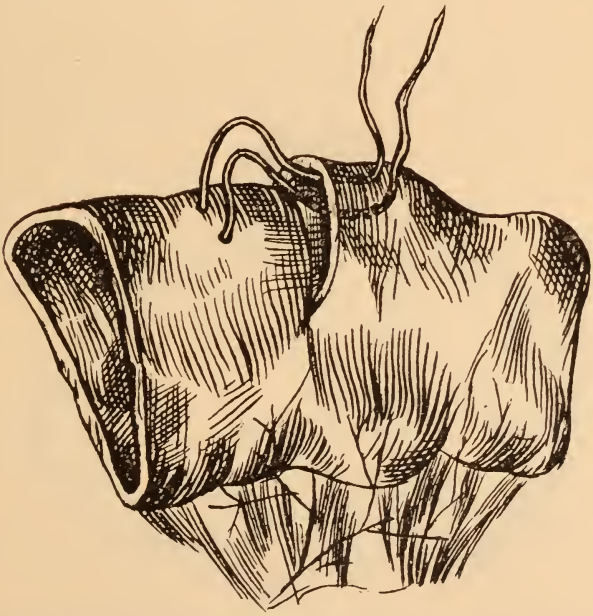


Fig. 22. Chopart and Desault's method of uniting transverse wounds of the intestine. *a*, suture in place; *b*, suture tied.

Richerand. The researches of Bichât have shown that mucous membranes do not contract adhesions with each other; and that adhesive inflammation takes place most surely and speedily between serous surfaces.

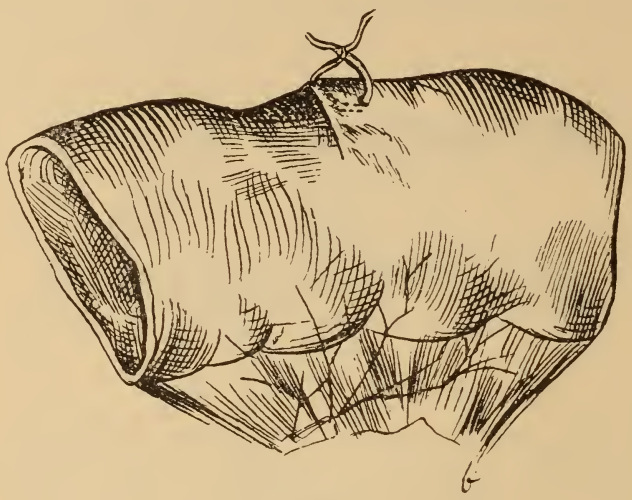


Fig. 22 *b*.

Travers ("An Inquiry into the Process of Nature in Repairing Injuries of the Intestines." London, 1812) experimented with the old suture including all of the tunics of the bowel, but cut the threads

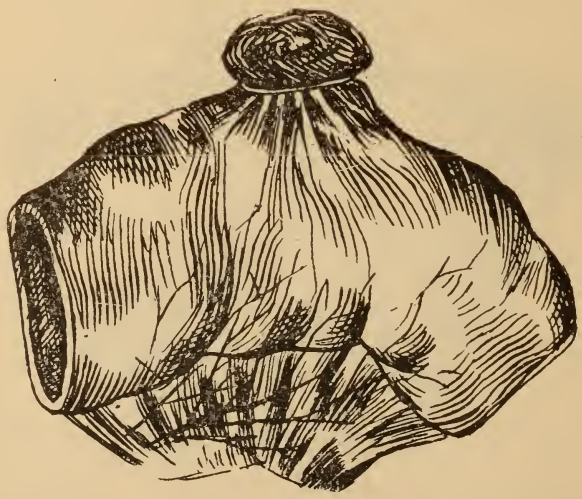


Fig. 23. Astley Cooper's method of dealing with small wounds and circumscribed gangrenous patches.

short to the knot and did not fasten the intestine against the abdominal wall as had been the general custom up to that time. He found that the intestinal wounds in animals thus treated usually healed. The sutures cut their way through the tissues in the direction of the lumen of the bowel and passed away with the feces. He placed the sutures very closely so as to secure ample mechanical protection against escape of fluids, while Astley Cooper placed them much farther apart, using only a sufficient number to prevent fecal extravasation. In small wounds and limited gangrene Astley Cooper made a small cone on the affected side of the bowel by seizing the wound or gangrenous patch and applied a ligature of fine silk around the base. The ligature cut its way into the bowel during the time the defect became sealed by plastic lymph. The necrosed mass and ligature escaped into the bowel through the defect made by the ligature.

II—MODERN METHODS.

The researches of Richerand, Bichât and Travers prepared the way for Lembert to institute a complete revolution in the application of the intestinal suture. Until his time the discovery that adhesions take place most rapidly between serous surfaces was ignored in the use of the intestinal suture, and if success followed the surgeon's efforts the result was attributable less to the suture than the circumscribed plastic peritonitis, the product of which buried the sutures and sealed the wound by a mass of plastic lymph. To Lembert is conceded almost by universal consent the credit of having established the modern doctrine concerning the healing of intestinal wounds. As is the case in all great discoveries, claimants for priority were not wanting. Jobert ("Arch. Gén. de Méd.," T. iv. p. 73) has claimed this honor; Faure ("Arch. Gén. de Méd.," T. x. p. 474) alleges that when he was a pupil of the Hospital of St. Louis, he had proposed, before the year 1820, the approximation of serous surfaces in intestinal wounds. Denans ("Soc. Méd., de Marseilles," 1826) also mentions that the suggestions of his process were made without knowledge of the work done by Lembert and Jobert. Lembert claims that he published his first paper on this subject in 1825. ("Bull. de Ther.," T. ix, p. 325.) Denans began his experiments in 1823, but they were not published until March, 1824, and the Archives for January of the same year contain a description of the process of Jobert. There can be no question that through the labors of Lembert the new doctrine gained a firm foothold and was promptly adopted not only by his countrymen but by the surgeons in England and Germany. Lembert's technique and

practice brought about a sudden transition from the ancient to the modern methods. Since his time a great variety of methods have been proposed with a common object in view; to bring into opposition the serous surface of the margin of the wound.

Lembert's work initiated the most important era in the history of the intestinal suture. He must always be regarded as the founder of modern successful intestinal surgery. The technique of intestinal work is still open to improvements, but the great principle inculcated by Lembert to rely on the serous coat in procuring early and permanent adhesions will never be rejected.

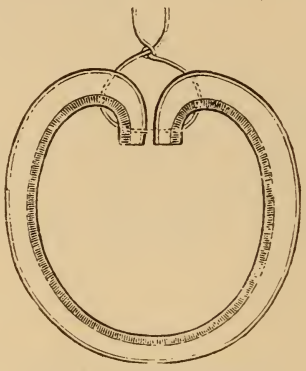


Fig. 24. Lembert's suture.

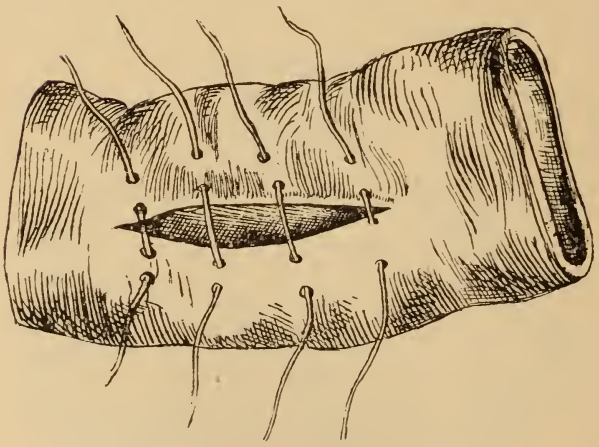


Fig. 25. Lembert's sutures in place.

His first paper on this subject was published in 1826. ("Répertoire Général d' Anatomie et de Physiologie pathologique," T. ii, 3, 1826). He used interrupted sutures of fine silk, and cut the threads

short to the knot, making no provision for fastening the bowel against the abdominal wound. The point of the needle is introduced upon the external surface of the intestine at the distance of two or three lines from the margin of the wound; he penetrates through the tissues as far down as the mucous membrane, brings it out at one or two lines distance from its place of entrance; applies the needle with the same precautions upon the external surface and into the tissues of the opposite side. He places the sutures about three to four lines apart, and when they are all in place commences to tie from one end, turning the margins of the wound carefully toward the lumen of the bowel with a probe.

After completion of the suturing the part presents externally a linear depression with a corresponding ridge on the inner side. This

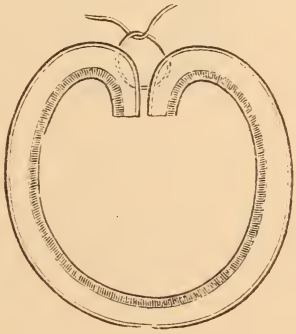


Fig. 26. Jobert's suture.

method secures serous approximation to the extent of space included by the sutures. The sutures become encysted and do not cut their way into the lumen of the bowel. Lembert's suture has been variously modified at different times. Jobert included in the suture the entire thickness of the wall of the bowel.

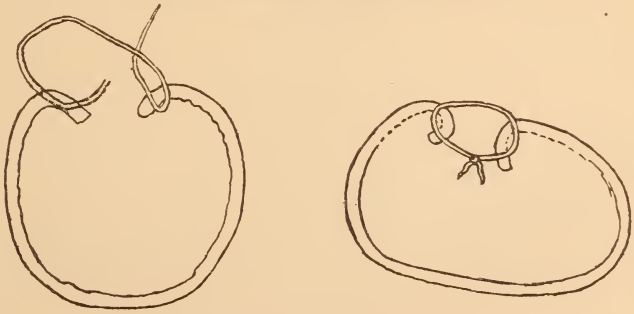


Fig. 27. Breidenbach's suture.

Breidenbach tied the knot on the inside of the lumen of the bowel.

Dupuytren made the Lembert stitch in the form of the continued suture.

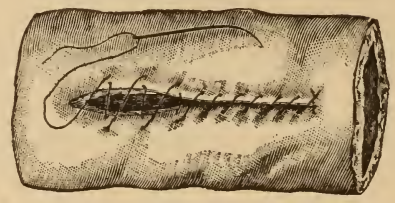


Fig. 28. Dupuytren's suture.

Dieffenbach included in the suture only the peritoneal coat.

Gély ("Recherches sur l' emploi d' un nouveau procédé de suture contre les divisions de l' intestin," Paris, 1844) armed each end of the thread with a needle. A loop is formed by transfixing the serous and muscular coats at one end on each side of the wound about 4 mm. from the margins of the wound, grasping about 5 mm. of surface. The needles and threads are then crossed and similar stitches taken and the process repeated until the opposite angle of the wound is reached, starting with the stitch at the subsequent point of exit of the needles. By making traction on the threads the margins of the wound are neatly inverted and only one terminal knot is required.

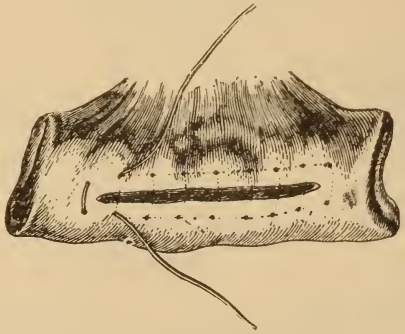


Fig. 29. Gèly's suture.

According to Nélaton the advantages of this method are: that the sutures close the wound hermetically and that the thread can escape into the lumen of the bowel.

Blatin's modification of Gély's method consists in using only one needle and two threads of different color, first sewing with one and returning with the other, avoiding the punctures made by the first needle.

Emmert's ("Lehrbuch der Chirurgie," Stuttgart, 1862, p. 232) method of suturing intestinal wounds consists of a series of double Lembert sutures as is well illustrated by Fig. 30.

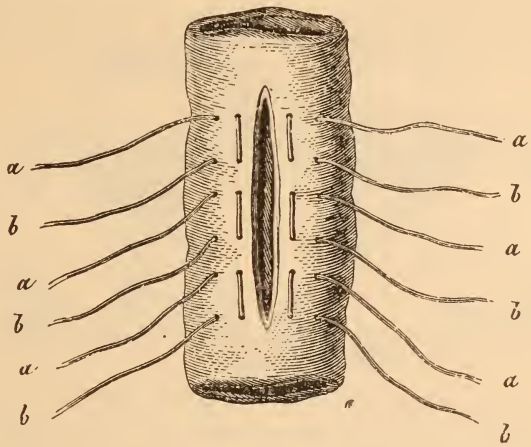


Fig. 30. Emmert's method.

When the sutures are all in place the corresponding threads on each side are tied and the margins of the wound are carefully inverted.

A very strange method of closing intestinal wounds was devised by Bouisson. Two insect pins of the length of the wound are pushed through the tissues parallel to and about 2 mm. from the margins of the wound. The pins are pushed in and out from the surface of the intestine in the same way as in making a continued suture. A ligature is passed under the free parts of the pins on each side at different points, and as they are tied the margins of the wound are inverted and approximated. All the threads are brought out of the external wound. On the third or fourth day the pins are withdrawn, thus releasing the ligatures, which are also removed. Lembert's principle of uniting serosa to serosa was first applied in making the invagination suture by Jobert. ("Mémoires sur les plaies du canal intestinal," Paris, 1827). He modified Ramdohr's method by turning in the edge of the lower end before making the invagination, thus bringing serous surfaces in contact for adhesion. The invagination is made by inserting two sutures at opposite points in the upper end and passing the ends with a needle through the inverted margin of the lower end a few lines apart. By making traction upon the sutures invagination is effected and maintained by tying the sutures.

Jobert's suture has had an extended trial in restoring the continuity of the bowel in the treatment of complete transverse wounds, and has yielded fair results. The most objectionable feature to it is

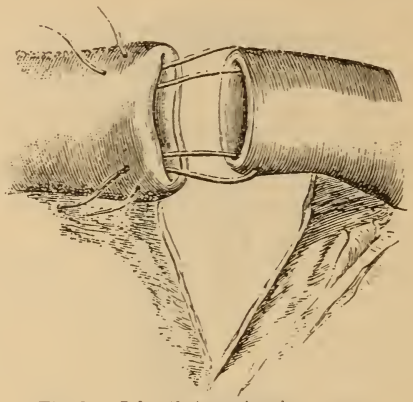


Fig. 31. Jobert's invagination suture.

the fixation suture, which being composed of unabsorbable material must finally cut through the tissues which it includes before it can escape into the bowel, a process which is necessarily attended by no inconsiderable risk of extravasation and its consequences—septic peritonitis and death.

Schmidt, Thompson and Travers had observed the singular phenomenon, viz., that if a thread is applied around a small perforation of the intestine, it soon sinks into it as into a depression, in such a manner as to reach gradually the interior of the canal and to become entirely free there, at the same time that the serous coat or surface of

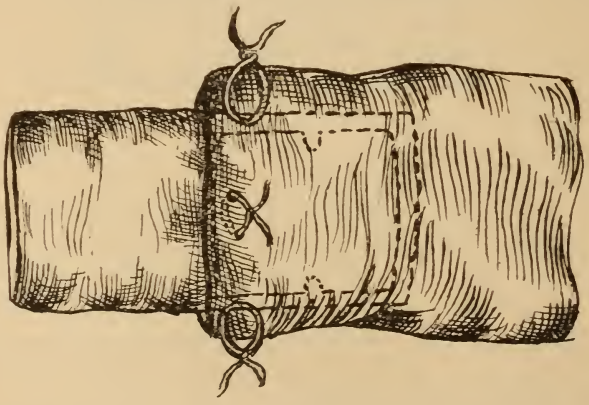


Fig. 32. Amussat's method of invagination and circular constriction. *a*, Invagination; *b*, circular constriction.

the bowel is united behind it and blended with a layer of plastic lymph as if intended to fill up the opening which, but for that, would have been left. Still more, Travers has found that if the entire caliber of the intestine is strangulated, the peritoneum of the upper portion adheres so rapidly to that of the deeper tissues, that the septum

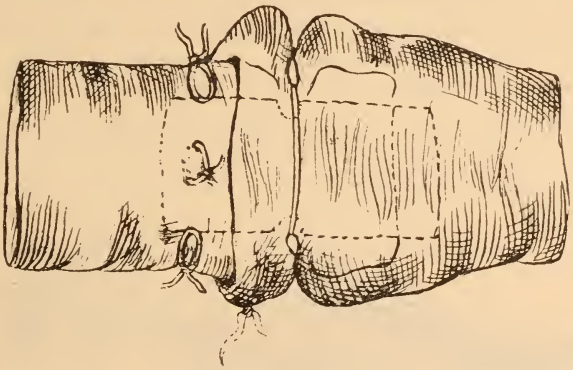


Fig. 32 *a*.

formed by the strangulation soon becomes gangrenous, and is detached and drawn in the direction of the lower part of the bowel in such a manner that the tube ultimately becomes perfectly re-established. Utilizing these facts as a basis, Amussat ("Casper's Wochenschrift f. d. Medicin," 1834, No. 44), made use of invagination and circular construction in re-establishing the continuity of the intestinal canal.

In order to maintain the patency of the bowel he inserted a hollow cylinder of elder into the upper end before making the invagination. This cylinder had a circular groove in the center. The invagination was maintained by a few sutures. A thread was then tied firmly around the bowel at a point corresponding with the circular groove.

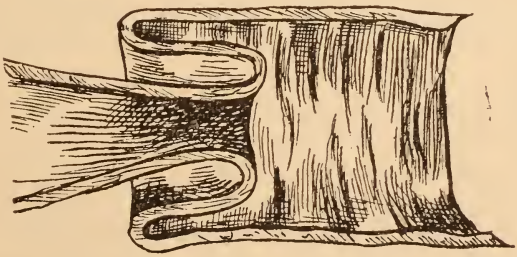


Fig. 33. Béclard's procedure. *a*, Invagination; *b*, circular constriction.

As soon as the string had cut its way into the bowel the cylinder was released and passed away with the feces, while the serous surfaces on each side of the groove made by the string became adherent.

Choise ("These de Paris," 8837, No. 322), experimented on animals by inserting into the upper end a piece of the trachea of an animal, and after invaginating this into the lower end tied a ligature firmly around the invaginated portion. The ligature soon ulcerated through into the bowel, adhesions between the approximated serous surfaces formed in the meantime, and the ligature and tracheal ring escaped with the feces. The experiments on lower animals were successful. He later substituted a piece of cork for the trachea and obtained similar good results.

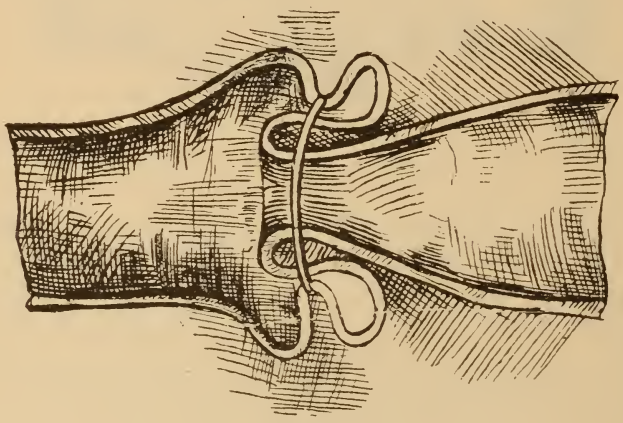


Fig. 33 *a*.

Béclard obtained the same results in his experiments on animals without the use of a cylinder.

After making the invagination he constricted the bowel by tying a thread firmly just below the margin of the ensheating tube. Zang (op. cit.), detached the mesentery from the upper end to the distance of an inch, and invaginated this part into the lower end after turning in its margins. The invagination was maintained by a mesentic suture which grasped both sides, the threads of which were brought out of the external wound and fastened so as to hold the invaginated part in the ventral wound. Various efforts have been made at different times to dispense with intestinal sutures by substituting for them some other kind of mechanical support. One of the earliest attempts in this direction was made by Denans ("Recueil de la Societé roy. de Méd. de Marseille," l'Anne. 1, 1826), a

surgeon of Marseilles. The procedure is an exceedingly ingenious one. In effecting an end-to-end union in the treatment of complete transverse wounds or after resection, he introduces into each end of the bowel a ring of silver or zinc, over which he inverts the margins of the ends of the bowel and connects them by a slightly smaller but wider ring of steel which is cut longitudinally, the margins overlapping so that it can be made smaller by pressure, and exert the necessary peripherial pressure to hold the other two rings firmly together. The central ring is compressed with a pair of strong forceps when it is first inserted into the upper end of the bowel, then into the lower, when the two rings are approximated over it, thus grasping firmly the inverted margins all around. The serous surfaces outside of the grasp of the rings become adherent, the inverted margins subjected to pressure between the rings slough, the rings are released and pass away with the stools.

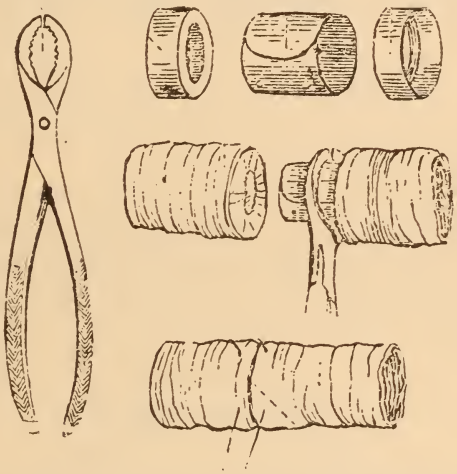
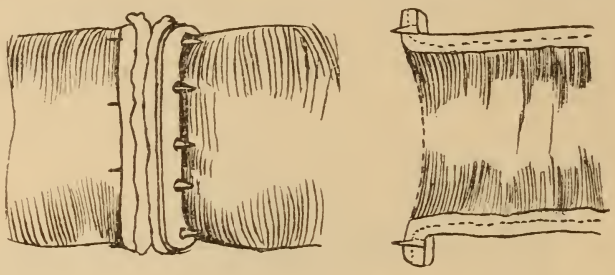


Fig. 34. Method of Denans. *aa*, Rings for bowel ends *b*, connecting steel spring ring; *c*, upper end of bowel containing ring and proximal end of connecting ring; *d*, lower end of bowel containing ring, margin of bowel turned inward; *e*, two ends joined together; *f*, forceps to aid in the insertion of middle ring.

In his first experiments the connecting piece was a perfect ring, and in order to prevent separation of the ends of the bowel he used two points of suture, as will be seen in the illustration (e). Later ("Note a l'Acad. de Med.," 1838), he used the steel spring ring for the connecting part and dispensed with the sutures. His experiments on animals proved very successful. Guersant reported a successful case. Nelaton admires the perfection of the mechanism of this method, but makes the serious objection to it that the rings are not

always at hand when needed. and that the passage of such a large foreign body is a matter of difficulty and might lead to fatal complications.

Baudens modified Denans' method by using a single cylinder with a deep transverse groove in the center and two rubber rings. The inverted margins of the bowel ends were fastened upon the cylinder by the rubber rings pressing in opposite directions towards the center of the groove on the outer surface of the cylinder.



a. *b.*

Fig. 35. Method of Henroz. *a*, one end of bowel with ring *in situ*; *b*, ends joined together between the two spiked rings; *c*, ring showing spikes and perforations for spikes of opposite ring.

The inverted margins subjected to the elastic pressure sloughed and came away with the cylinder and rubber rings.

Henroz clamped the two ends of the bowel together between two rings, each supplied with a number of sharp metallic points which transfixed the mucous membrance, and by taking hold in perforations in the ring on the opposite side held the rings together and fixed the bowel ends.

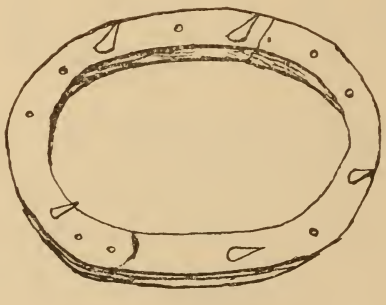
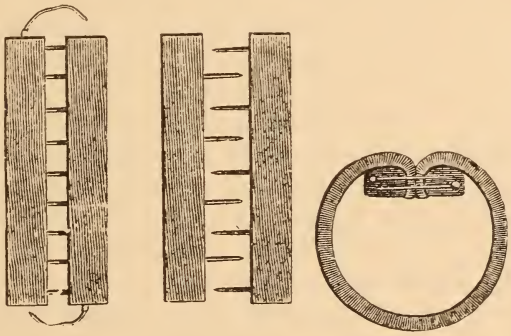


Fig. 35 *c*.

The great objection to this method is that the margins of the ends of the bowel were not inverted; union was effected with the mucous membrance turned outward, consequently it must have proved a failure even in experiments on the lower animals.

Somewhat similar mechanical contrivances that I have described above in the end-to-end approximation of the intestine have been devised in the treatment of longitudinal and incomplete transverse wounds.

Beranger-Feraud ("Des diverses methodes de re-union des plaies intestinales," Paris, 1870), invented a clamp which he regarded as being especially applicable in the treatment of longitudinal wounds.



B *A* *C*

Fig. 36. Beranger-Feraud's cork clamp suture. *a*, clamp ready for use; *b*, clamp closed; *c* clamp in place holding the serous surfaces of the inverted margins of wound in contact.

Two quadrangular prisms of cork 6 mm. in thickness and as long as the wound are prepared. Fine insect needles are pushed through these pieces of cork about 6 mm. apart, in such a manner that the heads well pushed into the cork are covered with sealing wax. One of the prisms is inserted into the wound, and the points of the pins are made to penetrate the entire thickness of the intestinal wall near the margin of the wound from within outward. After the other prism is in place, the serous surfaces are brought in contact by pressure from without against the prisms, so as to bury the points of the pins in the opposite piece of cork sufficiently deep to insure adequate pressure. The included parts slough away with the clamp; meanwhile adhesions form between the approximated serous surfaces outside of the clamp. For the purpose of giving greater security the two pieces of cork can be fastened together in addition by a curved pin as is shown in Fig. 36, b.

Bobrick ("Med. Vereinszeitung," 1850), described another kind of clamp suture. The clamp is made either of sheet lead or a thin strip of silver the length of the wound. The metal strip is folded in the center in its long axis like the cover of a book, before it is inserted into the bowel through the wound. The margins of the wound

are then inverted and engaged between the two leaves of the clamp, when by pressure from without the clamp is closed sufficiently firm to fix the parts included securely. Adhesions form in a short time on the surface outside of the grasp of the clamp, the included parts slough and escape with the clamp. The greatest objection against all the substitutes for the intestinal sutures that have been mentioned is that a foreign body is left in the intestinal canal which necessarily constitutes additional source of danger, because spontaneous elimination is attended by many difficulties and risks. In this regard the experimental results are not directly applicable to man. The intestinal canal of dogs is much shorter in proportion to the size of the body than that of man, and the muscular coat is much more developed. Dogs are reckless eaters, and for this reason they have been supplied with an intestinal canal that can dispose of foreign bodies of large size and most dangerous forms. This is not the case in man, hence leaving a foreign substance of any considerable size in the intestinal canal of man is fraught with danger.

That Lembert's method of treating intestinal wounds and its many modifications did not give universal satisfaction becomes evident from a paper published by Privat in 1846. ("Bull. de Therapie," Sept., 1846). Under the title of *Autoplastie* he described in this paper a new method of dealing with intestinal wounds which he successfully applied in a case of penetrating wound of the abdomen complicated by four intestinal wounds. The wounds were first sutured and fastened in the abdominal wound by mesenteric loops. The sutures tore through on the second day, when he fastened over each wound an adjacent intestinal loop. On the seventh day three of the wounds were closed and the intestine was returned into the abdominal cavity. The fourth wound was not quite closed and was retained in the external wound. It closed later and the patient made a perfect recovery. He is of the opinion that intestinal wounds can be healed more rapidly by covering them with an adjacent healthy loop than by suturing. It will thus be seen that in spite of great improvements over the ancient methods, the progress made did not answer the practical demands.

III—RECENT METHODS.

The second great improvement in intestinal suturing was the introduction of the aseptic suture by Sir Joseph Lister, nearly a quarter of a century ago. We can readily understand that the old septic suture was the direct cause of death in many cases in which

the operation was faultlessly performed. Lister taught us to use aseptic material for the sutures and to apply the other principles of antiseptic surgery in the management of intestinal as well as other wounds. The adoption of this method of wound treatment removed a frequent source of septic peritonitis and added much to the success and rapid development of intestinal surgery. The aseptic suture in aseptic tissues no longer constituted a source of danger. Under this plan of treatment absorbable sutures were removed by absorption, unabsorbable material became encysted without causing harmful irritation. The catgut suture that met at first with such a warm reception by surgeons in the treatment of intestinal wounds has been gradually displaced almost completely by the aseptic silk suture, so that at present but few surgeons rely upon it in the treatment of an intestinal wound. Czerny (Sammlung Klinischer Vorträge, 1881, No. 201) added another row of stitches to Lembert's sutures. He wished to approximate not only the peritoneal surfaces, but also the margins of the mucous membrane in order to prevent escape of intestinal contents between the parts brought in apposition by Lembert's stitches and to place the parts in an ideal condition for repair.

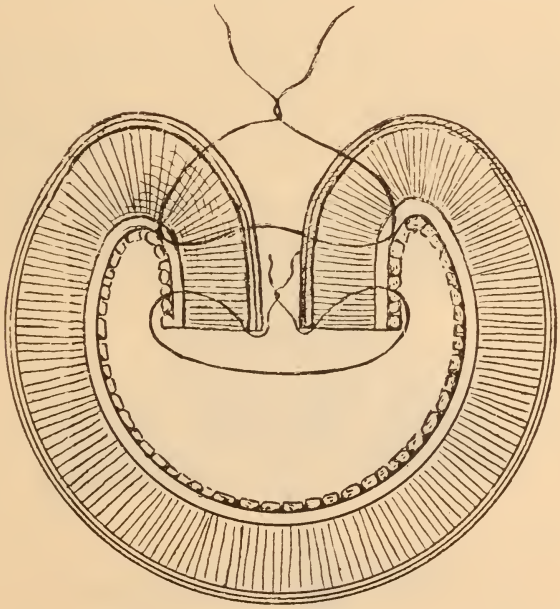


Fig. 37. Czerny-Lembert suture.

Czerny's modification of Lembert's method consists in uniting first the mucous membrane by a row of stitches, which, with the exception of the last one or two, are tied on the mucous surface. These stitches ulcerate into the lumen of the bowel, while the superficial or Lembert's stitches become encysted. In all cases in which two rows of stitches are used in closing a wound or in performing circular enterorrhaphy, this method is usually practiced. If time permits, this method is safer than any of the single row methods.

Gussenbauer devised a figure-of-eight suture which was intended to accomplish the same objects as the Czerny-Lembert suture.

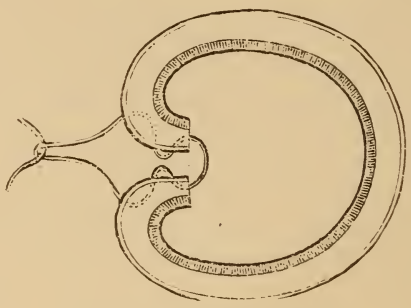


Fig. 38. Gussenbauer's suture.

It is much more complicated than the Czerny-Lembert suture, and does not bring the parts in apposition as accurately, and for these reasons is seldom employed. In circular enterorrhaphy Wölfler sutures the mucous membrane from the inside of the bowel, brings

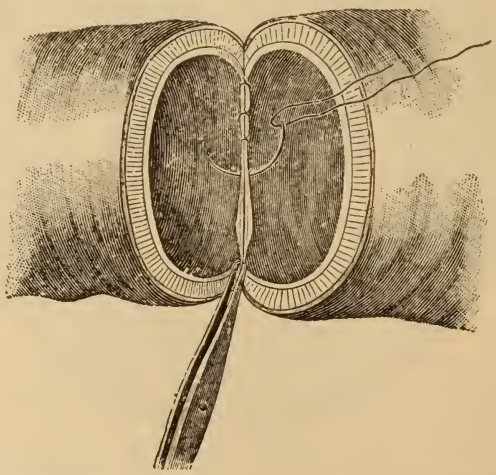


Fig. 39. Wölfler's suture. *a*, Deep sutures; *b*, superficial sutures.

the serous surfaces in contact by Lembert's stitches and, if necessary, applies over these a continued suture of fine silk or catgut.

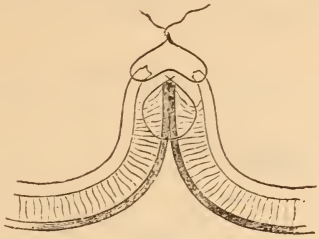
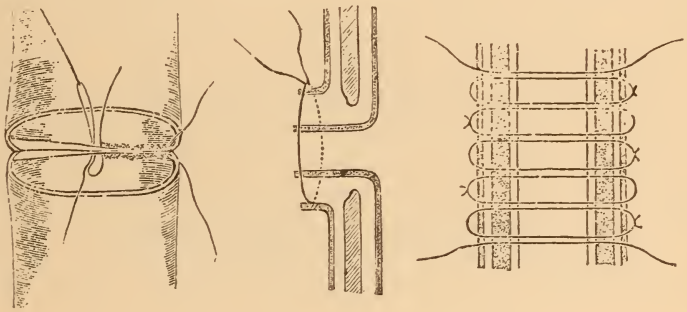


Fig. 39 *B*.

Madelung (Verh. d. Deutschen Gesellschaft f. Chirurgie, 1881) used in circular suturing small discs of cartilage made from the costal cartilage of a calf, with which he aimed to secure better approximation between the serous surfaces than by the unaided suture alone.

Bishop (*Medical Chronicle*, September, 1885) has devised and successfully employed in the lower animals an ingenious, and in his experimental work a satisfactory suture. It is a kind of interrupted shoemaker's stitch introduced on the mucous side, each suture loop being tied on alternate sides of the line of junction.



a. *b.* *c.*

Fig. 40. Bishop's suture.

The stitches are all on the mucous side of the bowel, and as they tend to produce too much narrowing of the bowel the method will never receive the sanction of the practical surgeon.

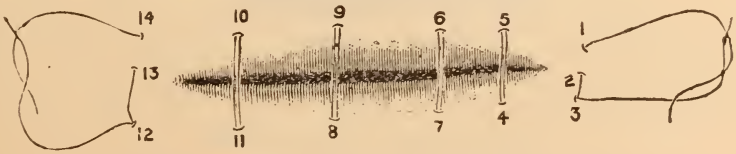
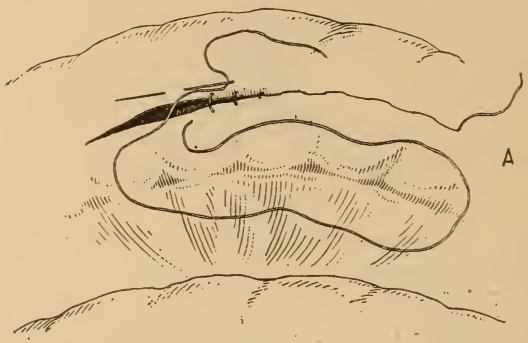


Fig. 41. Greig Smith's modification of Appolito's method.

Greig Smith's modification of Appolito's suture consists in doing away with the necessity of placing a foreign body in the intestines to which the end of the suture is attached. Smith credits this suture with giving wonderfully good apposition.



H. W. Cushing ("Right Angle" Continuous Intestinal Suture. Medical and Surgical Reports of the City Hospital of Boston, 1889) has still further modified Appolito's method, and has perfected it to such an extent that it has become one of the sutures that is entitled to general recognition. The first stitch is knotted as soon as a hold upon the bowel has been obtained, and the right angle stitches are now commenced. The thread is then carried to and fro across the wound, and is finally knotted at the opposite side of the wound. The author of the exceedingly interesting pamphlet from which these facts are gleaned says: "The most satisfactory results are obtained in the human intestine by placing the points of puncture one-eighth of an inch apart, and by burying the suture to the same extent in a direction parallel to, and three-sixteenths of an inch distant from the wound edge. The suture terminates in the tough, fibrous submucous layer, and is not intended to involve the mucous membrane or penetrate the

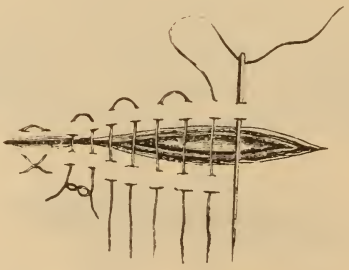


Fig. 43. Halsted's plain quilt suture.

intestinal cavity. Each part of the suture should be drawn tight, so as to accurately appose the wound edges before the next is set."

Halsted's (*International Journal of Medical Sciences*, October, 1887) plain quilt suture is a compromise between Emmert's and Cushing's suture.

He places great stress upon the importance of including in the sutures a few of the firm fibers of the submucous coat, which he has studied so carefully and described so well. He claims for this suture that it does not strangulate the tissues so much and obtains a firmer hold than the Lembert stitch. It is, however, a more time-consuming procedure than the ordinary method by Lembert stitches. and more confusing to the inexpert surgeon. The mucous membrane has always been in the way of the surgeon in dealing with intestinal wounds. Moreau and Poutard excised the prolapsed mucous membrane before suturing, in order to prevent the interposition of this structure between the peritoneal surfaces and to secure a wider surface of healing. Kummer (*Verhandlungen d. Deutschen Gesellschaft fur Chirurgie*, 1891, p. 121) has carried this procedure farther, and under the name of submucous resection of the intestine he describes a form of circular suturing in which a circular strip of the mucous membrane half an inch wide is excised on each side prior to bringing the parts in apposition by sutures.

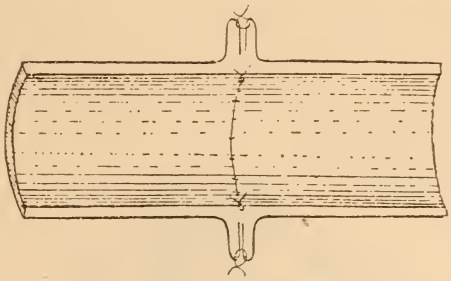


Fig. 44. Kummer's method of circular suturing.

The mucous membrane is sutured separately on the inner side of the bowel; the remaining part of the bowel wall appears in the form of a ridge, which after inversion of the peritoneal surfaces is sewed separately. The lumen of the bowel is not narrowed at the seat of suturing. and an extensive area of wound surface is included by the sutures. The method, however, is objectionable, as it necessitates a maximum degree of traumatism and consumes too much valuable time.

Chaput ("Congres Francais de Chirurgie," 1889) does not excise the whole mucous membrane, as just described in Kummer's method, but removes only the epithelial lining by scraping. The mucous membrane is everted and a circular strip one centimetre wide on each side is denuded with a sharp curette. In sewing them together he brings in contact the scraped surfaces and covers the line of suturing with omentum. The invagination method, after scraping off the lower end in a similar manner, yielded such bad results in his experiments on dogs that it was never tried on man.

Robinson (*Annals of Surgery*, 1891) described a new method of end-to-end suturing. A rubber tube from four to six inches long is inserted into the proximal end and stitched around the edge The mucous membrane of the distal end is dissected off with curved scissors and then curetted for about one-half inch. The proximal is then invaginated into the distal end, so that the peritoneal surface is in contact with denuded mucous membrane. A row of stitches around the circumference of the distal end, which, however, does not penetrate the lumen of the proximal bowel, completes the operation.

M. E. Connell (*Medical Record*, September 17, 1892) has made some very interesting experimental investigations in circular enterorrhaphy with a special view of reducing the number of stitches and knots.

After a circular resection the cut ends of the bowel are placed in position represented by Fig. 45 *a*. and the first or tight suture is inserted, as shown by *b*. After tying this suture the parts will represent the appearance as in *c*. In making the second or loose suture the needle is inserted from without inward through the wall of the bowel,

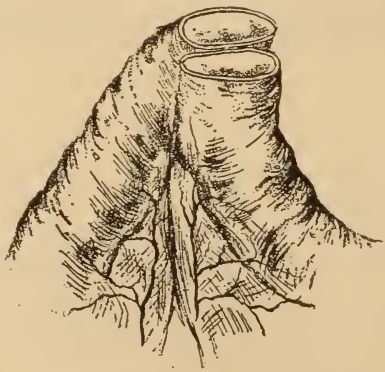


Fig 45. Connell's suture for circular enterorrhaphy.

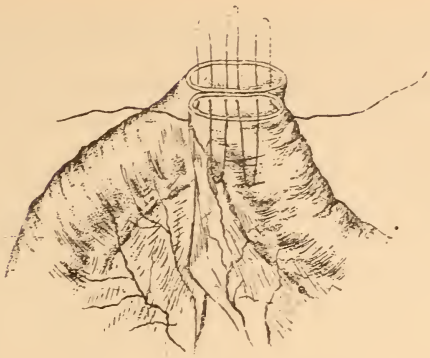


Fig. 45 *B*.

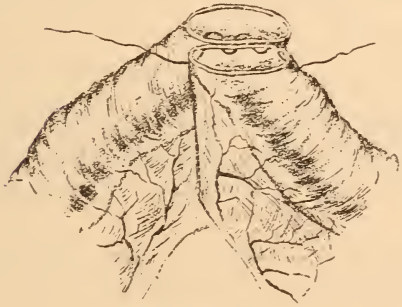


Fig. 45 *C*.

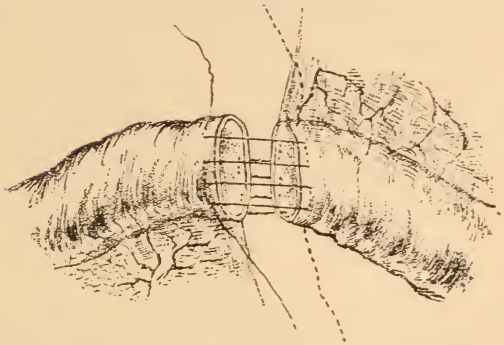


Fig. 45 *D*.

at the convex end, and passed out again on the same side ; it is then crossed over the cut edges to the opposite wall, and a stitch is taken through all the coats about three-sixteenths of an inch in length, parallel with the margin of the cut edges; it is now passed back again and a stitch is taken as before. This is repeated until enough stitches

have been taken, when the needle is brought from within outward through the mesenteric end. When this suture has been inserted, and before it has been drawn tight, it appears as in *d*. When the suture is tightened the margins are inverted and the serous surfaces approximated.

Maunsell, of New Zealand, ("A New Method of Intestinal Surgery."—*American Journal Medical Sciences*, March, 1892) has devised a method of circular suturing in imitation of nature's processes in the spontaneous cure of an invagination.

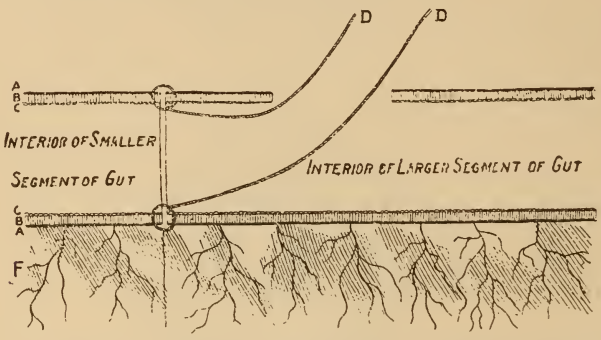


Fig. 46 *A*. Longitudinal section of gut showing AA, peritoneal coat. BB, muscular coat. CC, mucous coat. DD, temporary sutures passed into bowel and out through longitudinal slit made in larger segment of gut. F, mesentery.

The two ends of the bowel are brought together with two temporary sutures passed through *all* the coats of the intestine. The long ends of these sutures are left intact. One is placed at the mesenteric attachment, and the other at a point directly *vis a vis*. These sutures are used later in effecting invagination. On the side in which the temporary invagination is to be made the bowel is incised to the extent of

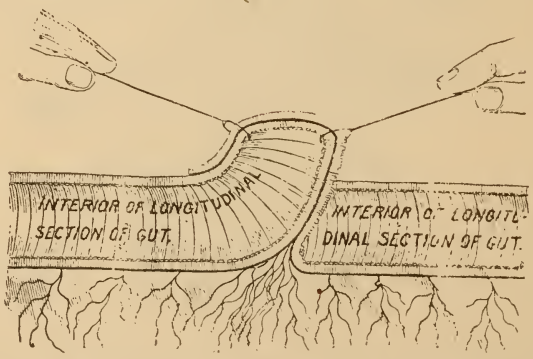


Fig. 46 *B*. Maunsell's artificial invagination and circular suturing.

an inch and a half, on the convex side parallel to its long axis, as is shown in Fig. 46 *a*.

The edges of the longitudinal slit made in the bowel, which begins about an inch from its cut end, should be well turned in and brought together with continued suture of Lembert's stitches. By this simple device the perfect union by suture of a complete transverse section of the bowel, with its circumferential peritoneal surface in exact position and all knots of the sutures on the inside, can be accomplished. From diagram *b* (longitudinal section of intestine, showing the relative position of the different layers of the bowel invaginated at the longitudinal slit) it may be seen that the peritoneal surfaces are in accurate apposition all around. While an assistant holds the ends of the temporary sutures the surgeon passes a long, fine, straight needle, armed with a stout horse-hair or a very fine silk-worm gut, through both sides of the bowel, taking a good hold of all the coats. The suture is then worked up from the center of the invaginated intestine, divided and tied on both sides. *In this way twenty sutures can be placed rapidly in position with ten passages of the needle.* (See diagram *c*.) The temporary sutures are now cut off short, and the

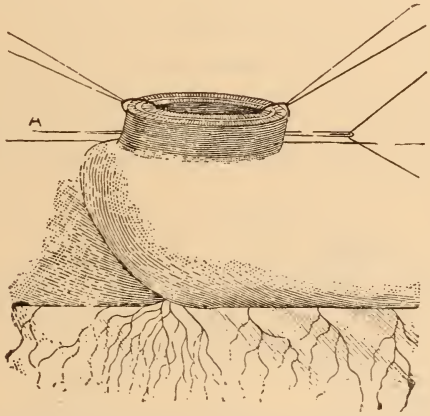


Diagram C. Invaginated gut, showing the two peritoneal surfaces in juxtaposition all all around. A needle passed through both sides of the bowel, including all the coats, introducing two sutures with one passage of the needle.

sutured ends of the bowel painted with Wölfler's mixture of alcohol, glycerine and colophonium, and dusted over with iodoform. The bowel is then pulled back. The longitudinal slit in the gut is well turned in and closed with a continuous suture and plaited with Wölfler's mixture and iodoform powder. This method of suturing has yielded excellent results in experiments on animals and recommends

itself for a careful study to every surgeon. A serious objection to this method is the additional wound through which the temporary invagination is made.

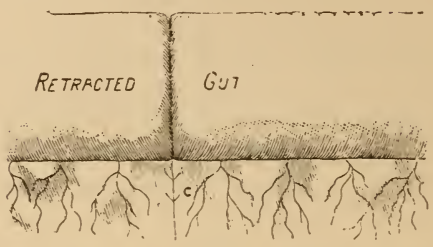


Diagram D. Appearance of bowel after completion of operation.

M. L. Harris ("Circular Enterorrhaphy; A New Method."—*Chicago Medical Recorder*, September, 1892) has devised a new method of circular enterorrhaphy which in dogs has given excellent results. The distal end of the bowel is denuded of its mucous membrane for the distance of one and one-half to two centimetres with a sharp curette. The upper end is then invaginated into the lower in such a manner that the serous surface of the upper end comes in contact with the denuded submucous layer of the lower.

Three ordinary round sewing needles of a good length are threaded with fine sterilized silk. The first needle is made to transfix the thickness of the lower or denuded end of the bowel just to one side of the mesentery and at the inner limit of the denudation. It is not

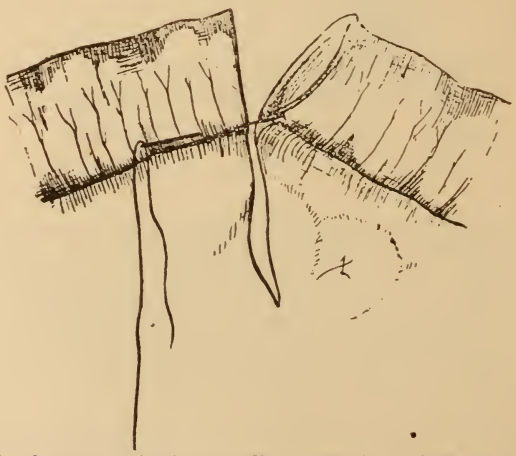


Fig. 47. Circular enterorrhaphy according to Harris. *a*, invagination suture.

drawn clear through, but only until the point projects from the caliber of the bowel a little beyond its free edge. The point of the needle is made to pick up a bit of the other end of the bowel, transversely, just to one side of the mesentery and very near to its edge, Fig. 47.

Now, by drawing the needle back a little and using it as a lever by turning it around its point of transfixion in the lower end, it will be readily seen that the upper end, on this side, is invaginated into the lower end as far as the part is denuded of its mucous membrane.

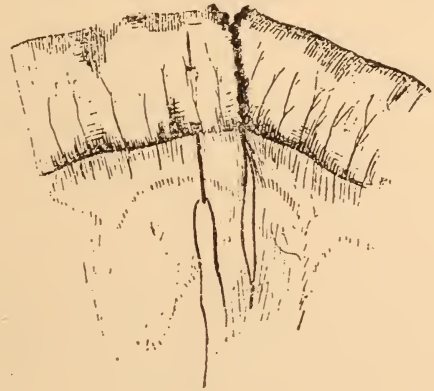


Fig. 47 *B.*

The point of the needle is then pushed on through the lower end from within outwards a short distance in a line transversely from the first point of entrance, where the needle is left temporarily, transfixing the bowel and holding that part of the upper end invaginated. Fig. 47, *b.* (b, partial invagination.) The same process is repeated with the second needle at a corresponding point of the bowel on the opposite side of the mesentery, while the third needle is used simi-

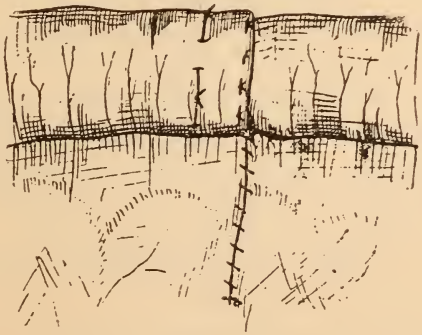


Fig. 47 *C.*

larly at the part of the bowel opposite to the mesenteric attachment. As will be observed (Fig. 47, *c*), there are two rows (*c*, operation completed) of sutures around the bowel, one at either end, thus permanently keeping the opposed surfaces in accurate contact regardless of the varying caliber of the bowel. It is the first row of sutures around the invaginated end to which the success of the method is due, and it was because Chaput failed to recognize it in his invagination method that his operation was a failure and every one of his animals died. Harris is of the opinion that it is not material in which direction the invagination is made when this method is employed. Although all of the animals operated on by this method lived and the specimens obtained later showed excellent results, I cannot but believe that any method which deviates from the principles established by Lembert is a step in the backward direction, and that few if any surgeons will have the courage to deviate from them when called upon to assume the responsibilities of such operations on his fellow-beings.

The tendency has recently been toward the employment of some kind of an aid or substitute for sutures in effecting an end-to-end union of the intestine. Senn ("Intestinal Surgery," Chicago, 1889, p. 168), has modified Jobert's method of invagination by substituting catgut for silk for the invagination sutures and by lining the upper end of the bowel with a flexible rubber ring. The operation is described as follows: "The upper end of the bowel which is to become the

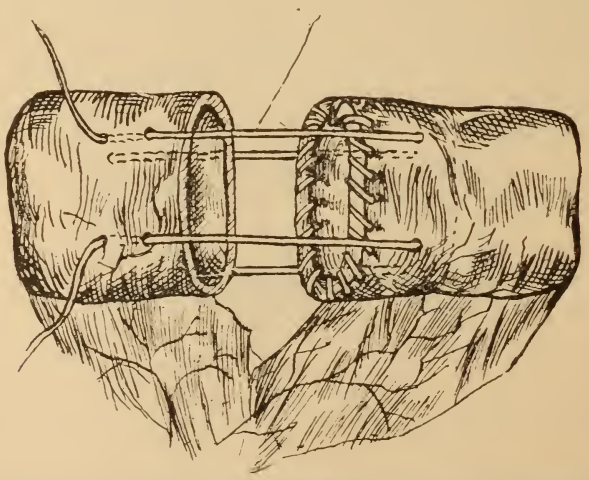


Fig. 48. Senn's modification of Jobert's invagination method. *a*, upper end lined with ring, invagination sutures in place; *b*, lower end; *c*, invagination completed, sutures tied.

intussusceptum is lined with a soft pliable rubber ring made of a rubber band, transformed into a ring by fastening the ends together with two catgut sutures. This ring must be the length of the intussusceptum, from one-third to half an inch: the lower margin is stitched by a continuous catgut suture to the lower end of the bowel, which effectually prevents the bulging of the mucous membrance, a condition which is always difficult to overcome in circular suturing. After the ring is fastened in its place the end of the bowel presents a tapering appearance which materially facilitates the process of invagination.

"Two well prepared fine chromicized or jumper catgut sutures are threaded each with two needles. The needles are passed from within outwards, transfixing the upper portion of the rubber ring and the entire thickness of the wall of the bowel and always equidistant from each other; the first suture being passed in such a manner that each needle is brought out a short distance from the mesenteric attachment, and the second suture on the opposite convex side of the bowel. During this time an assistant keeps the opposite end of the bowel compressed to prevent contractions and bulging of the mucous membrance. The needles next are passed through the peritoneal, muscular and sub-mucous coats at corresponding points about one-third of an inch from the margin of the opposite end of the bowel, and when all the needles have been passed an assistant makes equal traction on the four strings, and the operator assists the invagination by turning in the margin of the lower end evenly with a director or probe, and by gently pushing the rubber ring completely into the

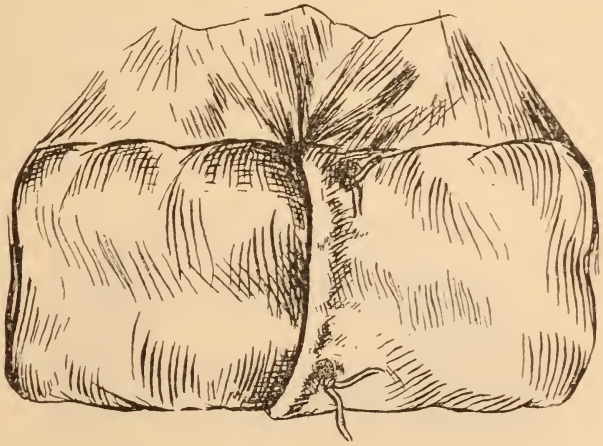


Fig. 48 C.

intussuscipiens. The invagination is accurately made, the two catgut sutures are tied only with sufficient firmness to prevent disinvagination should violent peristalsis follow the operation. The invagination itself effects accurate, almost hermetical sealing of the visceral wound. The intestinal contents pass freely through the lumen of the rubber ring from above downwards, and extravasation from below is impossible, as the free end of the intussuscipiens secures accurate valvular closure. After a few days the rubber ring becomes detached, and by giving way of the catgut sutures is again transformed into a flat band, which readily passes off with the discharges through the bowels. The invagination sutures of catgut are gradually removed by substitution on the part of the tissues, hence the punctures in the bowels remain closed either by the catgut or by the products of local tissue proliferation; and thus extravasation is prevented."

Neuber used a hollow cylinder of decalcified bone with a deep groove in the center as an aid in circular enterorrhaphy. (Fig. 49, *a.*)

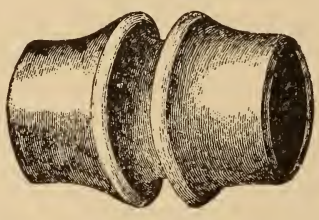


Fig. 49. Neuber's method. *a*, hollow cylinder of decalcified bone; *b*, longitudinal defect in bowel, showing location of cylinder, sutures, and catgut ligature.

After suturing the mucous membrance according to Wölfler's method so far that only an opening is left large enough to insert the cylinder, this is introduced in such a way that the transverse groove corresponds with the line of suturing when the serous surfaces are brought in contact by Lembert sutures. In order to fasten the united bowel securely upon the bone tube, a catgut thread is passed with a

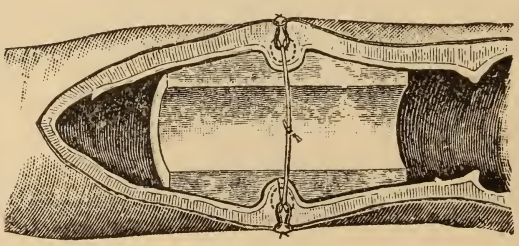


Fig. 49 *B.*

round needle through the mesentery, and tied around the bowel with sufficient firmness to press the margins of the sutured ends of the bowel into the groove. (Fig. 49, *b.*) This method has been employed in a number of cases with good results.

One of the most recent devices to take the place of sutures in restoring the continuity of the bowel in complete transverse wounds is the Murphy button. (*New York Medical Record*, December 10, 1892.) It is an exceedingly ingenious appliance, but its mechanism as far as uniting the ends of the bowel is concerned is no improve-

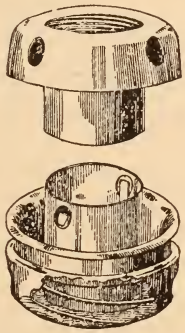


Fig. 50. Murphy's button.

ment upon the rings employed by Denans more than half a century ago. In both methods the margins of each end of the bowel are compressed and strangulated by the instrument with the intention of causing gangrene, and the resulting union is accomplished by adhesions between the serous surfaces outside of the grasp of the instrument. Both methods have also this in common, that a large foreign body is left in the intestinal canal which may becomes a source of danger on its way to the distal end of the alimentary canal. There is substantial ground for the two pertinent questions propounded by Henry Morris ("International Encyclopœdia of Surgery," 1884, p. 944) in commenting on the procedure of Denans: "Who would venture to leave the intestine in this manner in the belly? Who would guarantee that the metallic tubes would not perforate the intestine?" Any instrument, suture or ligature used in effecting the continuity of a wounded or divided bowel that produces gangrene must be looked upon as a source of danger. It is impossible to effect an aseptic necrosis in the interior of the bowel, and dead tissue inhabited by pathogenic microbes always constitutes a source of danger. It is easy enough to produce gangrene, but we are powerless in limiting

its extension in this locality. The limited area of living tissue brought in contact outside of the rings of Denans or the Murphy button will not always prove adequate in the protection of the peritoneal cavity against perforation and its immediate result—septic peritonitis. I have knowledge of a number of cases in which the parts approximated by the Murphy button were found completely separated at the post-mortem examination. As a means of end-to-end union of the intestine, the Murphy button is certainly inferior to Denans' procedure or the method that will be next alluded to, because the lumen of the connecting part is not large enough as a temporary outlet for the intestinal contents above the seat of operation. The size of the button is also a very serious objection. I have operated for intestinal obstruction produced by a gallstone less than an inch in diameter which had become impacted in the lower end of the ileum, and other surgeons will recall similar instances. Keen (*Annals of Surgery*, June, 1893) gives the post-mortem record of a case of malignant disease of the colon in which an anastomosis was established by using a Murphy button one inch in diameter. The patient survived the operation forty-seven days. The anastomotic opening had become reduced one-half in size by contraction during this time. In a post-script he says: "The button should be abandoned for intestinal or gastro-intestinal anastomosis."

If this warning of so eminent a surgeon foreshadows the final verdict of the profession in regard to the use of the button for anastomotic purposes it will never come into use in end-to-end approximation.

A few days ago I received an interesting brochure from Adelbert Ramauge, professor of surgery in the medical faculty of Buenos Ayres, entitled "Enteroplexie," a paper which he read at a meeting of the International Medical Congress of South America, January 20, 1893, and which received the first prize, a gold medal, from the Peruvian government. In this paper I find the description of an

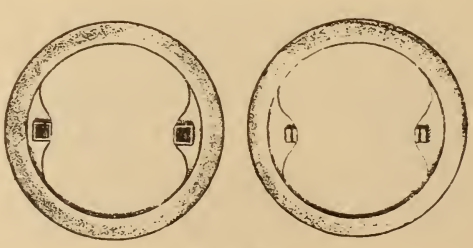


Fig. 51 *A*.

instrument which is intended for the same purpose as the Murphy button and which bears a strong resemblance to it.

Fig. 51 *B*.

Fig. 51 *C*.

Fig. 51. *A*. Ramauge's method of end-to-end approximation. *a*, platinum rings, front view; *b*, platinum ring, side view, showing male and female connecting parts; *c*, rings joined together; *d*, longitudinal section of bowel, showing position of rings and included parts.

Its mechanism as far as the end-to-end approximation is concerned is the same as that of the button.

The rings are made of aluminium. The connection between the rings is made by two instead of one part. This is a decided advantage, as the size of the temporary outlet is thereby increased. As the rings are composed of aluminium, they are much lighter than the button, and for this reason less likely to become arrested on their way

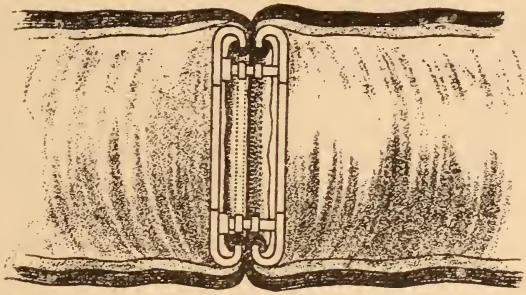


Fig. 51 *D*.

through the intestinal canal. The objections which have been made against Denans' rings and the Murphy button otherwise apply with equal force to this procedure.

The revival of intestinal anastomosis by Billroth and Senn has opened up a new field for experimentation with different kinds of sutures and their substitutes. The author ("Intestinal Surgery," Chicago, 1889) made many operations on dogs by suturing the two

visceral wounds which were intended to form the anastomotic opening by the Czerny-Lembert method, and notwithstanding that the greatest care was exercised in carrying into effect the antiseptic details, and with a view of a perfect technique, nearly 50 per cent. of the animals died, either from the immediate effects of the operation or from complications resulting from the operation. For the purpose of gaining time and doing away with the evil accruing from too many sutures, and finally with the intention of securing a greater surface of approximation of the serous surfaces and complete rest for the parts

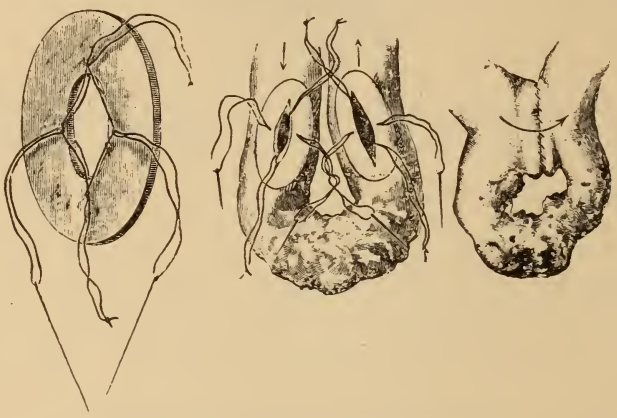


Fig. 52. Senn's method of performing intestinal anastomosis. *a*, perforated decalcified bone plate with sutures attached; *b*, plates inserted through longitudinal slit in bowel on each side of obstruction, lateral ligatures passed through margin of wound on each side; *c*, the four approximation sutures tied, cut short to the knot, and serous surface over margins of plates sewed together with continued suture.

it is intended to unite, he substituted for the sutures approximation plates. The idea was suggested to him by Dr. M. E. Connell, superintendent of the Milwaukee County Hospital. The first experiments were made with plates of wood, lead, gutta percha and other indestructable substances, nevertheless nearly all of the animals recovered. The material for the plates that was found the most useful after many trials was decalcified bone. The appearance of the plates and their method of use in making an intestinal anastomosis are well shown in the accompanying illustration taken from the last edition of Esmarch's "Chirurgische Technik."

The serous surfaces included between the plates are scarified for the purpose of securing early and firm adhesions. The plates furnish the necessary mechanical support until firm adhesions have formed, when they disintegrate and pass away in fragments. The two lateral sutures fall into the lumen of the bowel. The mistake was first made

in operations on man in making the perforation in the plate and the longitudinal wound in the bowel too short, hence the anastomotic opening was too small from the beginning. For gastro-enterostomy and intestinal anastomosis, I now use moist plates (kept between glass plates in an antiseptic solution) with a perforation at least three inches in length and make the visceral wounds correspondingly long. Since I have adopted this change, I have had no trouble with the anastomotic opening. Different kinds of material have been substituted for the decalcified bone. Abbe and Matas used catgut rings, Brokaw segmented rubber ring, Robinson rawhide and segmented rubber plates, Davis catgut mats, Stamm cartilage plate, Shrively and Simonson chromicized gelatin plates, Dawbarn potato plate, von

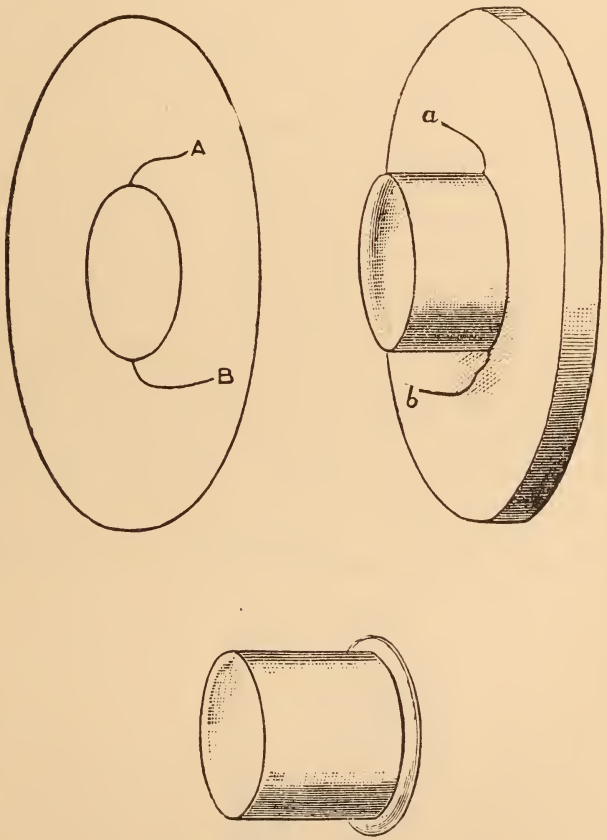


Fig. 53. Intestinal anastomosis after Littlewood. *a*, decalcified bone plate, central opening for connecting tube; *b*, decalcified bone plate with connecting tube inserted; *c*, connecting cylinder.

Baracz Swedish turnip plate, and a French surgeon has recently proposed plates made from shavings of the hoofs of horses. H. Littlewood (*The Lancet*, April 16, 1892) has suggested a modification of Senn's plates, with the idea of doing away with the four stitches attached to the upper and lower margins of the apertures of the plates, of performing the operation more quickly and of insuring a good opening between the two pieces of the intestine.

The suggested modification is to fix a tube of decalcified bone (*c*) into the aperture of one of the plates (*b*). This should be made to accurately fit into the aperture of the other (*a*); by this method the two plates could be held together, and the two parts of the intestinal walls between them brought evenly into contact with each other. He suggests that it might be well to have a piece of fine silk attached to each of the ends of apertures (as marked *A a*, *B b*, in diagrams *a* and *b*), so that by tying *A a* and *B b* together greater security would be made. The intestinal walls around the margins of the plates should be attached by a few sutures.

Willy Sachs (*Centralblatt f. Chirurgie*, October 4, 1890) has described a very similar modification. He proposes the use of an appliance resembling in form a sleeve stud, perforated in the middle. This is made up of two decalcified bone plates fixed together, yet separated to a small extent from each other as far as the uniting portion immediately around the central portion. A longitudinal incision having been made in each of the opposed portions of intestine, each disc is inserted into the intestinal canal on either side, and the intestinal anastomosis is thus readily and speedily established. Sutures are then applied through the serous coat on each side wherever there is a tendency to protrusion of the mucous membrane. He tested this method so far only on rabbits.

A. W. Mayo Robson ("A Method of Performing Intestinal Anastomosis by means of Decalcified Bone Bobbins."—*British Medical*

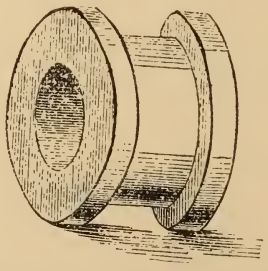


Fig. 54. Robson's decalcified bone bobbin.

Journal, April, 1893), uses a contrivance very similar to that of Sachs' which he calls decalcified bone bobbin. He has used this method with success in two cases.

In making an intestinal anastomosis each end of the tube is inserted into the bowel through a longitudinal incision and fastened to the connecting portion by a continued marginal suture. After this has been done on each side the serous surfaces are united by superficial sutures.

IV—PRESENT STATUS.

Enough has been said on the history and technique of the intestinal suture to show how much study, time, ingenuity and experimentation have been expended in its perfection, and yet the task has not been completed. The search for new sutures and their substitutes at the present time is sufficient proof that perfection has not been reached. Deviation from the legitimate path of investigation has done much towards retarding genuine progress. In this light must be viewed all attempts to ignore the principles established by Lembert and the employment of such foreign substances in the intestinal canal as means of approximation that necessarily produce gangrene, and of sufficient size to constitute an intrinsic source of danger. In the treatment of longitudinal and incomplete transverse wounds suturing by Czerny-Lembert sutures yields the best results. If time is an important factor a single row of Lembert stitches will answer the purpose. About six sutures to the inch are required. Halsted's advice to include in the stitches fibers of the firm submucous coat is important and should never be ignored. As a rule the line of suturing should be transversely to the long axis of the bowel in order not to encroach too much upon its lumen. Fine aseptic silk and ordinary sewing needles are to be employed. The inner row of sutures must include all tunics of the bowel with the exception of the peritoneum; the outer wall of the tunics minus the mucous membrane. The inner sutures ulcerate through into the bowel, the outer become encysted. Interrupted sutures are safer than the continuous, but in prolonged operations and when the patient is feeble, the latter can be substituted for the former as a time-saving measure. Extravasation during the operation is best prevented by digital or elastic compression on each side of the wound. The latter is made by passing a piece of fine aseptic rubber tubing through an opening in the mesentery made with a pair of hemostatic forceps, and tied around the bowel sufficiently firm to prevent escape of its contents.

If the bowel is completely divided its continuity can be restored with the greatest degree of safety by circular enterorrhaphy or invagination by the author's method. The latter is not applicable in operations for intestinal obstruction, as in that case the upper end of the bowel is larger than the lower into which the invagination must be made. Before suturing is commenced each end of the bowel should be beveled at the expense of the convex side, as advised by Madelung many years ago, as by doing so there is less danger of the sutures causing a dangerous degree of stenosis and the liability to marginal gangrene on the convex side is also greatly diminished thereby. If the lumina of the bowel ends are unequal in size, the obliquity should be greatest on the side of the small end. Circular suturing is performed in the same manner as suturing of incomplete wounds. The greatest care is required on the mesenteric side, as it is here where perforations occur most frequently. After applying the deep row of sutures the first Lembert stiches are applied on each side of the mesenteric attachment in order to secure serous approximation in this locality. The Lembert stitches must be tied only with sufficient firmness to approximate the serous surfaces without subjecting the included tissues to harmful linear compression. Puncturing of visible vessels should be avoided as much as possible. The mesentery is sutured in such a manner that it will aid in holding together the sutured end. Senn ("Intestinal Surgery," Chicago, 1889) has proposed and practiced omental grafting as a valuable aid in circular suturing. This additional protection against perforation and peritonitis is especially indicated when the tissues at the place of suturing have undergone pathological changes in consequence of intestinal obstruction or inflammation. A strip of omentum about an inch wide and long enough to cover the entire circumference of the bowel is used for this purpose. Prior to planting the graft the serous surface of the bowel half an inch from the line of sutures on each side is scarified, and the under surface of the graft is dealt with in the same way. The graft is fastened by two catgut sutures on the mesenteric side, including the mesentery and both ends of the graft. The stitches are made parallel to the mesenteric vessels. The grafts become firmly adherent within a few hours, and in the course of one or two hours are vascularized by new vessels growing into them from the scarified surface of the bowel. If any internal aids to circular suturing are used they should be composed of absorbable material and employed in such a way as not to produce marginal gangrene, and with a central opening large enough to allow free fecal

circulation. I cannot but regard mechanical supports made of metallic substances as dangerous. The objections made to them do not apply with equal force to the decalcified bone tube of Neuber, the sleeve button of the same material of Sachs and Littlewood, and the bobbins of decalcified bone of Robson. These appliances merit a trial and will undoubtedly be improved upon in the future.

Lateral anastomosis as a surgical procedure has a great future. I still remain partial to the use of decalcified bone plates as a substitute in part for sutures. Abbe has discarded the use of his catgut ring and now advocates long incisions and suturing. If the plates are made with an oval perforation three inches in length the same object is realized in a much shorter time and with a greater degree of safety. I never had any faith in rings as a means of approximation. The plates bring into accurate contact large serous surfaces and serve at the same time as splints for the injured part. They serve the double purpose of sutures and splints. The other appliances of decalcified bone that have been enumerated may answer the same purpose as the anastomosis plates, but with none of them can the pressure to which the included margins of the visceral wounds are subjected be regulated with the same degree of certainty, and none of them approach so near the function of splints. I have no doubt that future experiments will result in the discovery of other and safer appliances that will be vastly superior to anything I have mentioned, and that if they do not abolish, will at least greatly limit the present field of the intestinal suture.

The Chairman of Committee on Registration, Major Frank Anthony, Surgeon Illinois National Guard, asked for further time in which to make a report, as not more than half the members had been able to register and present their credentials.

The Chairman of Committee on Prize Essay, Col. H. L. Burrell, Medical Director, Massachusetts Volunteer Militia, submitted a report as follows:

"The Committee on Prize Essay would recommend the adoption of the following resolution: That the Association place in the hands of a prize essay committee, two hundred and fifty dollars ($250.00).

"This money to be invested by them and the income to be used to pay for a medal (bronze) to be awarded to the author of the essay

deemed worthy of such prize, in the opinion of the Prize Essay Committee."

Col. H. L. Burrell,
Col. Chas. Hayes.

Report accepted.

Referred to Committee on Resolutions.

The Chairman of Committee on Publication and Distribution of Major Carr's paper, Col. E. Chancellor, Medical Director, National Guard Missouri, submitted a report as follows:

The Committee beg leave to report that 5000 reprints of Major Carr's paper, "Some Needs of Our National Guard," were published and distributed as follows: Being one and two copies in a wrapper, to each member of the Senate and House of Representatives of the Fifty-second Congress, to all Governors of States and Territories, and to the individual members of their staffs, to the Adjutant-Generals of States, and Quartermaster-Generals, to members of Committee on Militia Affairs of the Senate and House of Representatives, of the various General Assemblies and Legislative bodies in the United States, to all National Guard surgeons who were non-members, and to many officers and regimental staffs, battalions and divisions of several States' National Guard, in the aggregate amounting to 1500 copies. Three thousand circular letters were printed and donated by the publishers and were judiciously mailed, giving in detail the price of reprints in 500 and 1000 lots, and only the members of the National Guard of Ohio and Missouri seemed to appreciate this generous offer on the part of the publishers, by purchasing and distributing the reprints to members of the National Guard of their respective States. The rates, as given, were as follows:

500	copies	at	$ 7 00
1000	"	"	10 00
1500	"	"	14 25
2500	"	"	22 50
5000	"	"	41 00

There remain about 3500 copies in the hands of the Secretary, to be disposed of as you may decree.

E. Chancellor,
H. L. Burrell.

Report accepted.

The following members volunteered to purchase 500 copies each of Maj. Carr's paper and requested that they be forwarded as soon as practicable: Col. Louis W. Read of Pennsylvania; Col. Nelson N. Henry, of New York; Col. R. E. Giffen, of Nebraska; Maj. L. C. Carr, of Ohio; Maj. Chas. M. Robertson, of Iowa.

The Chairman of Executive Committee, Major Chas. F. W. Myers, Surgeon National Guard of New Jersey, submitted the correspondence recently had with Surgeon-General Geo. M. Sternberg, United States Army, corncerning the change of name of the Association, and the admission of the officers of the Medical Department of the United States Army as active members, etc.:

HEADQUARTERS SECOND REGIMENT, N. G., N. J.,
CAMP WERTS, SEA GIRT, July 28, 1893.

To the Surgeon-General, United States Army:

SIR: Permit me, as a member of the Executive Committee of the Association of Military Surgeons, National Guard, United States, to inquire whether there can be any objection, officially or otherwise, for officers of the Medical Department, United States Army, to become active members in this Association?

When the Association was formed in Chicago in 1891 and the question of its title was discussed, Col. B. J. D. Irwin, United States Army, at that time on duty in Chicago, and present at meeting, suggested that regular surgeons could not become active members of such an association, and it was for this reason that the words "National Guard" were made a part of the title. Since that time opinions have been expressed by regular officers of the army, medical and otherwise, officers of the National Guard and distinguished civilians, that there can be no objection to such membership.

Medical officers of the National Guard are very anxious to be in the closest affiliation with their brethren of the Regular Army, and as a member of this Committee, it is my duty to report at the next meeting in Chicago upon an amendment to change the title of the Association by leaving out the words "National Guard"; upon the adoption of which medical officers of the army will be eligible, and of course immediately made members of the Association.

As time is now an important element, the meeting of the Association occurring on the 8th of August, I will esteem it a personal favor if you will reply to this letter at your earliest convenience.

Very respectfully,

Your obedient servant,

CHAS. F. W. MYERS,

Major and Surgeon, Nat. Guard of N. J.,

Member Executive Committee.

No. 108 Broadway, Paterson, N. J.

WAR DEPARTMENT,
SURGEON-GENERAL'S OFFICE.
WASHINGTON, July 31, 1893.

SIR: In reply to your letter of July 28th, I would say that I think the objection made by Col. Irwin, United States Army, at the meeting of your Association in Chicago in 1891 was well founded, but if you change the title to "Association of Military Surgeons," medical officers of the army could properly join the organization as active members, and I, as Surgeon-General of the Army, would do anything in my power to advance the interests of such an association. I am quite in accord with you and other officers of the National Guard in desiring to see the closest affiliation between medical officers of the Regular Army and of the National Guard. Should our country be so unfortunate as again to be engaged in war we would be brought together upon the field of battle and in general hospitals on terms of perfect equality, having the same objects in view, viz., the prompt relief of the sick and wounded by the most approved methods of modern medicine and surgery; and in time of peace the important duties of medical officers relating to the prevention of disease in camp, the drill of the Hospital Corps for the purpose of making it efficient in time of war, and all questions of administration, transportation of wounded, etc., are of equal interest to medical officers of the National Guard and the Regular Army.

Very sincerely yours,

GEO. M. STERNBERG,

Surgeon-General, U. S. A.

Major Charles F. W. Myers,
Surgeon, Nat. G'd. of New Jersey.
108 Broadway, Paterson, N. J.

Maj. Myers reported that after consideration his committee had found no obstacle whatever to the change of name,

"Association of Military Surgeons of the United States," and on motion the matter was referred to Committee on Resolutions.

On motion of Major Myers, which carried, a committee of three was appointed to consider the feasibility of a military medical journal and the plans for its management and support, and that the President be authorized to select the committee, which shall report at the executive session.

Maj. J. Wilks O'Neill, Capt. Chas. E. Woodruff, Col. E. Chancellor, committee.

Report to be referred to Committee on Resolutions.

The Chairman of Committee on Legislation, Col. C. M. Woodward, Surgeon-General Michigan State Troops (retired), submitted a report as follows:

Mr. President and Gentlemen of the Association:

As chairman of the Committee on Legislative Affairs I have the honor to report that early in November, 1892, I communicated by letter with each member of the committee as to the best time and method of presenting the memorial to Congress relative to the establishment of a military medical school. After due consideration the majority of the committee seemed of the opinion that our Association was not yet ripe for the introduction of such measures, and suggested the matter be again brought before this body for further consideration. One member of the committee personally did not believe in the establishment of a military medical school, and did not think one was necessary. Gentlemen, it is desired that the matter be placed before you for your consideration, and for such action as may be deemed expedient.

Respectfully submitted,

C. MEREDYTH WOODWARD,

Chairman of Committee.

Since writing out the foregoing report I clip the following from the Surgical Department of *Railway Age and Northwestern Railroader*: "We are pleased to note that Secretary Lamont, of President Cleveland's cabinet, has adopted the recommendation of Surgeon-General Sternberg, and ordered the establishment of an army school in Washington for the instruction of approved candidates for admission to the medical corps of the army. While this will be practically a post-graduate school, yet it is a step in the right direction, and may lead to a school which will take the medical student who has been properly

recommended for an army position, the same as the Government does the cadet, and educate him especially for that purpose."

If this is true, it seems that further action of this Association is unnecessary, except, perhaps, to officially approve of the action of Secretary Lamont and urge the further development of this school, taking the student through all the courses from the beginning of his professional studies to his graduation and entrance into the military service. C. M. WOODWARD, *Chairman.*

The chairman of Committee on Transportation, Major Lawrence C. Carr, Surgeon National Guard of Ohio, submitted a report as follows:

Owing to the fact that the time and place of meeting was changed, and Chicago selected, the rates then prevailing on account of the Columbian Exposition being much lower than the committee could possibly secure, your committee found no work to perform.

Report accepted.

The Chairman of Committee on Resolutions, Maj. M. C. Barkwell, Surgeon National Guard of Wyoming, asked that the Committee be granted further time, as several resolutions were now in hand and of such great importance that a conference of the entire committee was desired.

Col. E. Chancellor, moved that an executive session be held Wednesday morning, at 10 o'clock, at United States Army Hospital, Jackson Park, at which time the Secretary's annual report should be submitted as well as report from Committee on Printed Matter, and the chairman of Auditing Committee should be heard from.

Adopted.

The Secretary read the following official communications which were received from the headquarters of the Army and Navy, detailing certain representatives to this convention:

"SPECIAL ORDERS, NO. 152.

HEADQUARTERS OF THE ARMY,
ADJUTANT GENERAL'S OFFICE,
WASHINGTON, July 6, 1893.

EXTRACT.

* * * * * * * *

11. By direction of the acting Secretary of War, the following-named officers are detailed to represent the Medical Department of

the Army at the meeting of the Association of Military Surgeons of the National Guard of the United States, to be held in Chicago, Illinois, from the 8th to the 10th of August, 1893:

Colonel Bernard J. D. Irwin, Assistant Surgeon-General.

Major Valery Havard, Surgeon.

Captain Charles B. Ewing, Assistant Surgeon.

Major Havard and Captain Ewing will proceed to Chicago at the proper time, and upon the adjournment of the Association will return to their proper stations. The travel enjoined is necessary for public service.

* * * * * * * *

By command of Major-General Schofield:

R. WILLIAMS,
Adjutant-General.

Official:

WM. J. VOLKMAR,
Assistant Adjutant-General."

NAVY DEPARTMENT.
BUREAU OF MEDICINE AND SURGERY,
WASHINGTON, July 21, 1893.

SIR: I take pleasure in stating that Surgeon D. N. Bertolette, now on duty at the World's Columbian Exposition, Chicago, Ill., has been designated to represent the Medical Department of the Navy at the Meeting of the Association of Military Surgeons of the National Guard of the United States, to be held at Chicago, on the 8th, 9th and 10th proximo.

Very respectfully,

(Signed) J. R. TRYON,
Surgeon-General, U. S. Navy.

To Surgeon-General Nicholas Senn, Illinois N. G., President Association of Military Surgeons of the National Guard of the United States.

At one o'clock a recess was taken until 2 p. m.

ATTEST: E. Chouceller,
Secretary.

FIRST DAY—AFTERNOON SESSION.

The session was resumed at Rush Medical College at 2 o'clock P. M., with President Senn in the chair. Prof. W. W. Keen, M. D., of Philadelphia, was introduced and conducted a clinic on Brain Surgery*, which was largely attended by military surgeons and many distinguished physicians of the city, which was concluded at 5 o'clock P. M. After which an adjournment was taken until Wednesday at 10:30 A. M.

*Information has been received from the official stenographer that the complete report of Professor Keene's Clinic has been lost or destroyed, hence it is impossible to make a transcript for publication.

SECOND DAY—WEDNESDAY—MORNING SESSION.

At 10:30 A. M. the Convention met at United States Army Hospital, Jackson Park, in *an executive session*, with Col. Nelson H. Henry, Assistant Surgeon-General National Guard State of New York, in the chair and Major F. W. Byers as Sergeant-at-Arms:

The third annual report of the Secretary was submitted and read by the officer named:

Mr. President, Officers and Members of the Association of Military Surgeons of the National Guard of the United States:

GENTLEMEN—At the second annual meeting of the Association of Military Surgeons of the National Guard of the United States, held in St. Louis in April, 1892, it was decided, after an exciting contest, that the next annual meeting should be convened in the City of Washington, D. C., in May, 1893. A few months later, after mature deliberations of several officers and members of this Association at a conference held at President Senn's residence in December, 1892, it was thought that the best interests of the organization demanded that a ehange be made to Chicago, August, 1893, and acting upon the plausible suggestion advanced by Col. Greenleaf in a letter to Maj. Henderson, of Washington, D. C., the change was effected; and we

meet to-day in the grand city of lofty architecture, enterprise and wealth, which gave birth to this organization on September 17th, 1891.

The accouchment was conducted by a civilian soldier and one of the ablest and best known surgeons of modern times. The christening was witnessed and confirmed by many National Guard surgeons from different sections of the United States, and several distinguished representatives of the Medical Department of the United States Army.

No offspring ever had so many distinguished sponsors as were present on that occasion, and have since been added to the pages of its illustrious pedigree.

This epoch was the advent of a new-born organization destined for health and longevity, and at no distant date to be the most popular and influential institution of medical men in America. The growth and prosperity was conceived at its inception and the objects and fundamental principles, as outlined in the preamble, have been fully realized, and proved to be a talisman for its future government and success. The aims of the Association, as set forth in the certificate of incorporation, duly signed and ackowledged by the Secretary of State (Illinois), on June 13th, 1892, and secured from the Department of State through the courtesy of Hon. F. M. Estes of St. Louis, at a nominal cost, are as follows:

"The bringing of military medical officers in closer personal relations, and the development of a departmental *esprit de corps*, for the discussion of matters relating to the Medical Department of the Militia, for the discussion of military matters from a medical and scientific point of view, for the reading of papers on military medicine and surgery, hygiene and equipment and for the advancement and welfare of our civilian soldiers, whether in the field or at home."

MEMBERSHIP.

The roster of the Association includes 149 active members and fifty-one honorary members, and we have reason to point with pride to this enlistment and look with feelings of gratification at the good work accomplished, and the grand achievements that have given this Association a front rank among kindred organizations of the nineteenth century.

The loyalty and devotion to its welfare and upbuilding of its membership during the past year have characterized the earnest efforts of several members in the States of Connecticut, Rhode

Island and Pennsylvania, and we may confidently look for a general revivifying influence in the near future from our members throughout all the States, which can and will be accomplished by active, zealous and systematic measures. There are nearly 600 commissioned National Guard surgeons in the United States, and it is reasonable to conjecture that three-fourths of this number would be enrolled as members of this Association if the mutual advantages could be presented to each one personally. It is an unfortunate routine that the Medical Corps of the National Guard of the United States is annually subjected to so many changes in each State. These mutations are caused in the main by political vicissitudes, appointments, promotions and resignations, which necessitate a fluctuation in the membership.

Many become indifferent in National Guard affairs and in the the Association as soon as their term of office expires, or are forced indirectly, by the ballot box, to make way for a confrere, who happens to be on the lucky side and equally familiar and proficient with the scalpel and the first aid drill. We cannot hope for an improvement in these unfortunate results until appointments and commissions are made by competitive examinations, as now exist in the United States Army.

TRANSACTIONS AND DISTRIBUTION.

The proceedings of two annual meetings have been published by the Association in attractive and elegant form. The first volume has long since been out of print, and the demands have been very frequent and numerous, but could not be fulfilled. The second volume was greatly increased in size, superior in workmanship and handsomely bound, and was ready for delivery on August 1st, 1892. Seven hundred and fifty copies were published and disposed of, as follows:

The number of volumes distributed to honorary members, the daily press, several libraries, editors of medical journals, all surgeon-generals of the National Guard of the United States (non-members), heads of departments of the Army, Navy and Marine service, prominent citizens of St. Louis, Mo., who contributed largely to the success of the second annual meeting,

Amounting to.....	131	volumes.
Number of volumes distributed to active members	155	"
Number of volumes sold and accounted for	14	"
	300	"

Number of volumes of Transactions now on hand with

Wm. Becktold & Co., St. Louis, Mo.	200
Philip Roeder, St. Louis, Mo.	5
Col. E. Chancellor, St. Louis, Mo.	240
Chicago meeting, 1893	5
	450 vols.

Solicitations for the second volume have been many, and if your Secretary had complied with all the supplications that were received without the desideratum, the supply would have been exhausted long ago.

The distribution of the second volume of Transactions was accomplished through three express companies and the United States mails. In many cases it was found both beneficial, as well as economical, to forward the proceedings by express in five and ten volume lots, where several members resided in the same city or location, the agents at St. Louis giving a receipt in each case for package; the amount for expressage being collected at destination. Where members were isolated and living at a great distance from each other the Transactions were forwarded by mail, prepaid, at 12c. a copy. This latter mode of transit proved most satisfactory, as several complaints have been made on account of individuals not receiving a copy when sent in lots and in care of the member (in some cases) living in large cities. The sale of the second annual volume did not meet with the encouragement anticipated, which was possibly due to the neglect of sufficient advertising, or the price of the volume being thought excessive. Through the courtesy and generosity of Messrs. Wm. Becktold & Co., of St. Louis, they have two hundred volumes in their warehouse, which have been fully covered by insurance for one year.

FINANCE.

The stringency of the treasury at the close of the St. Louis meeting made it necessary for the President and Secretary to proffer a loan to meet the indebtedness for the publication of the transactions for 1892; whereupon Surgeon General Senn advanced $300.00 and the Secretary an equal amount. The vouchers for all sums expended are in the hands of the chairman of the Finance Committee.

The amounts received from members from May 1st, 1892, to August 1st, 1893, for initiation and annual dues, as well as sale of Transactions, were appropriated for current expenses, the total amount being $227.50.

The indebtedness of members to the Association is ample to meet all obligations and liquidate the present small deficiency, and it is hoped that your Committee on Finance will devise such means as will remedy the present financial tension.

SUGGESTIONS—STATE ORGANIZATION.

The objects and benefits of State organizations was fully set forth in the last annual address of the President of this Association, and it is a source of much regret that only a few States in the Union have followed the example of Wisconsin, New Jersey and Illinois, each having a prosperous and harmonious organization of all commissioned medical officers in their States.

It is hoped that this Association will take such steps as will tend to unite the National Guard surgeons of each State into a kindred association and closer relationship with the parent organization. In the furtherance of such an end it is suggested that the President be authorized to appoint a committee of three on State organization, with full power to act as in their judgment will be for the best interests of such affiliation.

STATE CORRESPONDENTS.

That the President shall be authorized to invite a suitable person in each State to act as correspondent and otherwise aid in promoting the purposes of the Association, in order that we may become better acquainted and more familiar with the work of each State organization, and the frequent changes made in the Medical Department in the several State Militias which by necessity must occur from time to time.

FINANCE COMMITTEE.

That the President shall appoint, at each annual meeting, three persons to constitute a Committee on Finance, Expenditures and Accounts, and that it be the duty of said committee to supervise collections and audit accounts, as well as to devise such means as will prove effective for meeting delinquent claims.

LIBRARY.

It is suggested that in consideration of the unsafe (non-fireproof) and limited quarters of the Secretary, that some means be devised for the care and preservation of the records, books, pamphlets, letters, circulars and property of the Association now on hand, which have rapidly accumulated within two years, and are too valuable to be destroyed. That, if feasible, a library be established in connection

with this Association, which shall be in charge of a librarian, to be appointed annually by the President, whose duties it shall be, in addition to his official acts, to make a report at each annual meeting.

FEES.

It is recommended that an entrance fee of $5.00 shall be paid by each active and honorary member on joining the Association, which sum shall be in lieu of the dues for the first year of membership. The annual dues shall not be less than $5.00, payable on January 1st. Membership shall cease by non-payment of annual dues for two years, and the list of delinquents shall be read at each annual meeting.

LIFE MEMBERSHIP.

The payment of a sum not less than $50.00 shall constitute a membership for life. In the event of a member being dishonorably dismissed from the service his membership in this Association shall be unconditionally forfeited.

CERTIFICATE OF MEMBERSHIP.

The Association shall issue a certificate of membership to such active and honorary members who have complied with the Constitution and By-laws, which shall receive the approval and signature of the President and Secretary.

PROPERTY OF THE ASSOCIATION NOW ON HAND.

1 Certificate of Incorporation, State of Illinois.
1 Seal of the Association.
275 Blank Certificates of Membership.
1 Half-tone Portrait of Dr. Matthews.
1 Half-tone Portrait of Dr. Eggers.
3500 Reprints of Major Carr's Paper.
450 Copies of the 2nd Vol. Transactions.
1 Half-tone Plate, Battlefield of Wounded Knee.
1 Electrotype Cut of Badge (a donation).
1 Rubber Stamp, President's Address.
1 Rubber Stamp, Date of Chicago Meeting.
1 Rubber Stamp, Name of Association.
1 Rubber Stamp, Return to Secretary.
3 Letter Files (*a*), St. Louis Meeting.
1 Letter File (*b*) for Application for Members (active).
1 Letter File (*c*) for Application for Members (honorary).
1 Letter File (*d*), Errors and Corrections, 1893.
1 Letter File (*e*), Adjutant Generals' Reports, 1893.
1 Letter File (*f*), Chicago Meeting.
1 Letter File (*g*), Bills and Receipts.
1 Letter File (*h*), Miscellaneous Correspondence.
1 Letter Copying Book.

1 Record Book, Names and Addresses of National Guard Surgeons, 1891.
1 Record Book. Names and Addresses of National Guard Surgeons, 1892.
1 Record Book, Names and Addresses of Honorary Members of 1893.
1 Small Box Red Seals.
3 Yards Red, White and Blue Ribbon.
52 Mailing Tubes for Diplomas.
100 Sheets Embossed Letter Heads.
300 Manilla Envelopes, printed, No. 10.
500 Manilla Envelopes, printed (a donation), No. 10.
500 Extra Manilla Envelopes (a donation), No. 10.
500 Extra fine Manilla Envelopes (a donation), No. 10.
75 Manilla Envelopes, 6½ by 9½.
65 One-cent Wrappers.
250 Letter Heads, Blocked.
1 Book of Receipts, Pacific Express Co.
1 Book of Receipts, Adams Express Co.
1 Book of Receipts, American Express Co.

ADJUTANT GENERAL'S REPORTS BY STATES.

ON HAND.

Alabama, 1889, 1890, 1893.
Arizona, 1893.
Arkansas, 1893.
California, 1889, 1890, 1891, 1892.
Connecticut, 1890, 1893.
Colorado, 1893.
Delaware, 1893.
Florida, 1890, 1893.
Georgia, 1890, 1892, 1893.
Iowa, 1889, 1893.
Illinois, 1889, 1890, 1893.
Indiana, 1889, 1890, 1893.
Kansas, 1889, 1890, 1893.
Kentucky, 1893.
Louisiana, 1890, 1892.
Maine, 1889, 1893.
Missouri, 1893.
Massachusetts, 1890, 1893.
Minnesota, 1890.
Maryland, 1889, 1892, 1893.
Montana, 1893.
Michigan, 1893.
New York, 1890, 1893.
North Dakota, 1890, 1892.
North Carolina, 1890, 1893.
New Hampshire, 1891, 1892.
Nebraska, 1889, 1890.
Nevada, 1890, 1891, 1893.
New Mexico, 1892, 1893.
New Jersey, 1890, 1893.
Oregon, 1891, 1892, 1893.
Ohio, 1890, 1893.
Pennsylvania, 1890, 1893.
Rhode Island, 1890, 1893.
South Dakota, 1890.
South Carolina, 1891, 1892.
Texas, 1889, 1890, 1893.
Tennessee, 1892.
Vermont, 1889, 1890, 1893.
Virginia, 1890, 1893.
Wisconsin, 1890, 1893.
West Virginia, 1890, 1893.
Wyoming, 1893.
Washington, 1892.
Washington, D. C., 1893.
Surgeon General of Army to the Secretary of War, 1886, 1890, 1892.
Register of the commissioned and warrant officers of the Navy of the United States and the Marine Corps, 1891.
England's monthly army list for July, 1892.

Report accepted.

The annual report of the Committee on Finance and Auditing was next submitted and read by the Chairman, Captain Chas. Adams, Assistant Surgeon of Illinois National Guard:

AUGUST 9, 1893.

MR. PRESIDENT AND MEMBERS OF THE ASSOCIATION—Your Committee on Finance and Auditing beg to report as follows:

In the absence of the Treasurer we are unable to make a full report, but would call attention to the account current of the Association with the Secretary.

Since the last meeting the expense account, vouchers herewith examined and found correct, has amounted to.....		$ 917 67
One item of this amount paid for printing the Transactions is.....	$ 585 20	
Incidental expenses have amounted to.....	332 47	917 67

The receipts during the same period have been as follows:

Sales of Transactions.....	$ 20 50	
Advertisement in Announcement.....	20 00	
From members for fees.....	187 00	
Cash from Col. Senn.....	300 00	
Cash from Col. Chancellor.....	390 17	$ 917 67

Thus it will be seen that the Association owes to Dr. Senn $300.00, and to Dr. Chancellor $390.17. This can readily be paid if all delinquent dues were paid, for it is estimated by the Secretary that the dues and initiation fees, up to the present meeting, now unpaid amount to $700.00 Our worthy Secretary asks for a remedy. We see only one, and that is for every member who is in arrears to settle at once and would suggest that the Treasurer be instructed to notify all members who are in arrears of their indebtedness to the Association, and after collection of said dues to reimburse the President and Secretary in such amounts as the Association is their debtor.

CHARLES ADAMS
A. H. BRIGGS.
Committee.

Accepted.

The report of Committee on Publication and Printed Matter was submitted and read by Chairman Col. E. Chancellor, Medical Director, National Guard of Missouri, as follows:

The Committee on Publication and Printed Matter begs leave to submit the following as the result of the work accomplished and disposition of all printed matter which passed through the office of the Secretary.

750 Vols. of Transactions. 1892.
3000 Envelopes, printed.
2000 Letter Heads.
125 Postal Cards for Transactions.
1000 Blank Applications for Membership.
2500 Letter Heads.
5000 Reprints Major Carr's Paper.
500 Certificates of Members. lithograph.
149 Copies of Circular Letter to Members asking for authentic name and address.
100 Copies of Circular Letter to Adjutant-Generals and Surgeon-Generals.
75 Copies of Circular Letter to Governors and Adjutant-Generals.
250 Mailing Tubes, printed.
500 Reprints from GLOBE-DEMOCRAT, St. Louis, Mo.
150 Copies of Circular Letter on Enquiry.
1250 Letter Heads.
1000 Circular Letters, Colonel Greenleaf's and Major Henderson's Letters.
1000 Printed Envelopes for Transactions.
1000 Preliminary Announcements.
500 Insert Slips.
500 Letter Heads.
250 Official Programmes for Third Annual Meeting.
3000 Circular Letters of Major Carr's Paper (printer's donation).

E. CHANCELLOR.
RALPH CHANDLER,
Committee.

Accepted.

On the motion of Major Carr:

Resolved, That the Treasurer send delinquent members a printed slip of the report of Chairman of Committee on Finance with the request that they remit their dues immediately.

Lieutenant Clark moved to amend Major Carr's motion:

Resolved, That the Treasurer notify delinquent members of their arrears, and in case they do not remit within thirty days, that a sight draft will be drawn on them for the amount due the Association.

The resolutions as amended were adopted.

The Committee on Resolutions, to whom was referred the resolution of Major Myers in regard to change of name of the Association, respectfully recommend that the style and title be:

"The Association of Military Surgeons of the United States."

M. C. Barkwell,
T. C. Clark,
Committee.

Adopted.

The Committee to whom was referred the "Draft of a 'Proposed Bill to Establish a Bureau of Public Health" beg leave to report that they would recommend the unanimous approval of the drafted bill by this Association.

M. C. Barkwell,
H. L. Burrell,
Committee.

Adopted.

DRAFT OF A PROPOSED BILL TO ESTABLISH A BUREAU OF PUBLIC HEALTH.

The undersigned, a committee of the National Quarantine Committee of the New York Academy of Medicine, have been instructed to prepare a bill to be submitted to Congress, creating a public health organization in the General Government. With a view to harmonize conflicting views on the plan of organization, about which there is a diversity of opinion, in order to concentrate upon a single measure the efforts of all who are interested in securing the necessary legislation, we herewith tentatively submit the sections of a bill organizing a Bureau of Public Health, for the purpose of eliciting a full and free discussion of the subject before finally determining the precise form which the committee will adopt. While the committee believes that the plan submitted is more nearly in accordance with the opinions of those whose judgment and experience are most valuable, it is prepared

to give due consideration to any modifications which may be proposed. The remaining features of the bill, which define the functions of the Bureau, will be submitted hereafter. All communications addressed to the secretary of the committee, Dr. J. H. Girdner, will be duly considered.

JOSEPH D. BRYANT, *Chairman.*
RICHARD H. DERBY,
EDWARD G. JANEWAY,
T. GAILLARD THOMAS,
DAVID WEBSTER,
STEPHEN SMITH,
J. H. GIRDNER, *Secretary.*

A Bill to establish within the Treasury Department a Bureau of Public Health.

Be it enacted by the Senate and House of Representatives of the United States of America, in Congress assembled:

SECTION 1. That for the purposes of this act the States and Territories of the United States be and are hereby grouped into districts, to be known as "The Sanitary Districts of the United States," as follows:

The Northern Sanitary District shall include the States of Illinois, Indiana, Iowa, Michigan, Minnesota, Ohio, Wisconsin.

The Northeastern Sanitary District shall include the States of Connecticut, Massachusetts, Maine, New Hampshire, New York, Rhode Island, Vermont.

The Northwestern Sanitary District shall include the States of Idaho, Montana, North Dakota, Oregon, Washington and the Territory of Alaska.

The Eastern Sanitary District shall include the States of Delaware, Maryland, New Jersey, Pennsylvania, Virginia, West Virginia and the District of Columbia.

The Western Sanitary District shall include the States of California, Nevada, Utah and the Territory of Arizona.

The Southern Sanitary District shall include the States of Arkansas, Alabama, Kentucky, Louisiana, Missouri, Mississippi, Tennessee.

The Southeastern Sanitary District shall include the States of Florida, Georgia, North Carolina, South Carolina.

The Southwestern Sanitary District shall include the States of Texas and the Territories of Indian Territory, New Mexico, Oklahoma.

The Central Sanitary District shall include the States of Colorado, Kansas, Nebraska, South Dakota, Wyoming.

SEC. 2. That there shall be established in the Treasury Department, under the direction and supervision of the Secretary thereof, a Bureau of Public Health, to consist of a commission of fifteen, of whom eleven shall be appointed by the President, by and with the advice and consent of the Senate, as follows, viz.: One medical commissioner from each of the "Sanitary Districts of the United States," provided in section 1 of this act, and two commissioners at large; the compensation of the appointed commissioners, when actually engaged in the performance of their duties under this act, shall be ten dollars per diem and reasonable expenses. The other four members of the commission shall be the Surgeon-General of the Army, the Surgeon-General of the Navy, the Supervising Surgeon-General of the Marine Hospital Service, and an officer, learned in the law, detailed by the Attorney-General from the Department of Justice; these four members shall receive no compensation.

SEC. 3. That the members of the commission shall meet at such time and place as may be designated by the Secretary of the Treasury, and organize by the election, from their own number, of a president who shall be one of the members at large, and who shall receive five dollars per diem, in addition to the ten dollars per diem provided in the last section, when actually engaged in the performance of his duties under this act. The commission may appoint a secretary, not one of its number, and fix his salary at a sum not exceeding three thousand dollars annually. The commission shall thereafter meet annually, at Washington, on the first Tuesday of October, and at such other times and places as the president of the commission, with the approval of the Secretary of the Treasury, shall designate.

SEC. 4. That there shall be an Executive Committee of the commission, consisting of its president, the Surgeon-General of the Army, the Surgeon-General of the Navy, and the Supervising Surgeon-General of the Marine Hospital Service and the officer detailed by the Attorney-General. The commission shall from time to time prescribe the duties of the Executive Committee, and may make all needful rules and regulations for its own control and for the guidance and discipline of all its officers and employes, and shall establish all rules and regulations for the government of national sanitation in all its foreign and interstate relations, and special departments in the enforcement of the provisions of this act.

SEC. 5. That when, in the opinion of the president of the commission, the interests of the public health would be promoted by a conference of the commission with the State Boards of Health of the several States, or of any sanitary district or districts, he is hereby authorized to invite, with the approval of the Secretary of the Treasury, said State Boards of Health, or such number thereof as he may designate, each to delegate one of its members to meet the commission in conference at such time and place as he may appoint. The president of the commission shall be the president, and the secretary of the commission shall be the secretary of any such conference. The delegate in attendance upon the conference from each State Board of Health shall be entitled to receive reasonable compensation for expenses for a session not exceeding three days, to be paid on vouchers provided by the Secretary of the Treasury.

On motion of Major Barkwell:

Resolved, that this Association express their high appreciation of the gratuitous services rendered by Hon. F. M. Estes, of St. Louis, in securing the Certificate of Incorporation for this Association by a unanimously vote of thanks.

Adopted.

On motion of Colonel Chancellor:

Resolved, that the Secretary be authorized to mail, postage prepaid, one copy of Second Volume of Transactions (1892) to each Governor, Adjutant General and Quartermaster General of each State and Territory.

Adopted.

The Committee on Military Medical Journal respectfully reports that a military medical journal is entirely feasible and essential, and that the interest of the United Services would be materially subserved by such a publication; that the journal should be published once in two months and as soon as contributions warrant it, it should be made a monthly journal; that the business management should be vested in the publisher, who should control the arrangement of articles contributed from whatever source and shall solicit desirable and profitable advertisement.

That there shall be an editor-in-chief and an associate or assistant editor representing the Department of the Army, Navy, Hospital Marine and National Guard. It is recommended that the associate editor for the National Guard be selected by this Association at this

meeting; that the associate editors shall be chosen by the Surgeons General of the respective services; that the associate editors shall have complete control in their respective departments, but that all original papers shall be sent to the editor-in-chief for his revision and should appear in the first part of the journal.

We recommend the publishers, Messrs. F. A. Davis & Co., who have already accomplished a great deal of work in this direction and who are willing to go forward immediately upon the assurance of sufficient literature and circulation.

The literature is ready and the circulation is based on the following figures: Subscriptions.....; Association of Military Surgeons, 175-200; Army, 150-200; Navy, 25-75; Marine Hospital, 125-200. These figures do not include subscriptions which your committee think will emanate from foreign countries.

We think a resolution should be offered making this journal the official organ of this Association; that this journal should be known as the "Military Medical Journal," devoted to the professional interests of the Army, Navy, Marine Hospital and National Guard of the United States."

J. Wilks O'Neill,
Chas. E. Woodruff,
E. Chancellor.
Committee.

Accepted.

On motion of Major Carr:

Resolved, That the Association communicate with Surgeon-Generals of the several States, calling attention to the present status of this Association, and recommending strongly that greater interest be taken at the headquarters of the several States, and further, that some effort be made to send representatives under orders to our annual meeting.

Adopted.

The Committee on Resolutions, to whom was referred the revision of the Constitution and By-laws respectfully recommend the following changes:

Article IX, to read: "An Assistant Secretary shall be appointed by the Secretary at each annual meeting."

Article XI. "This Association shall be composed of Active, Honorary and Contributing Members."

a. Active Members shall consist of commissioned Medical Officers of the United States Army, Navy, Marine Hospital Service, and National Guard or Volunteer Militia of the United States.

On application and presentation of the proper credentials to the Secretary of the Association, and on payment of the entrance fee, they may become active members of this Association, and shall retain their membership and rank should they be honorably discharged from the service in which they were commissioned, and entitled to wear the uniform of the rank held at the time of discharge from the service, upon payment of their annual dues.

Active Members shall alone be eligible to office or shall vote at the meetings of the Association.

b. Honorary Members shall consist of men who have been in the Medical Service of the National Guard or in the Medical Department of the Regular Army or Navy and Marine Hospital Service, or in that of the National Homes for Disabled Volunteers, or any distinguished military or naval surgeons from any part of the world, who from time to time may be unanimously elected. The names of persons nominated for this honor shall be referred to the Executive Committee on the first day of the annual meeting before they are balloted upon. They shall be entitled to all the privileges of Active Membership, except to the holding of office and voting.

c. Contributing Members.—Any person may become a contributing member who has in any way assisted in furthering the objects of this Association.

Members of this class shall be elected as prescribed for in Article XI., Section B."

Article XIII. "All voting at regular meeting of this Association shall be by representation; such representation shall be based on one vote each for each State, Territory, Army, Navy and Marine Hospital Service, in proportion of one vote for every ten members or fraction thereof, in good standing, present at the time of voting, said vote or votes to be cast by a member or members present from each State, Territory, Army, Navy and Marine Hospital Service, designated by the members present from each State, Territory, Army, Navy and Marine Hospital Service."

Article XIV. "The initiation fee of the Association shall be five dollars ($5.00), payable by each Active and Honorary Member, in lieu of the annual dues of the first year. The annual dues shall be five dollars ($5.00), due on the first of January."

Report accepted. Resolution adopted.

On motion of Maj. Barkwell the Constitution and By-laws were then read in detail, section by section, and afterwards adopted as a whole:

CONSTITUTION AND BY-LAWS

OF

THE ASSOCIATION OF MILITARY SURGEONS OF THE UNITED STATES.

PREAMBLE.

We, the undersigned, military surgeons of the United States, in order to promote and better the science of military surgery, do hereby agree to associate ourselves together and be governed by the following

CONSTITUTION.

ARTICLE I. The organization shall be known as "The Association of Military Surgeons of the United States."

ART. II. The Association shall meet annually, the time and place to be fixed at each meeting for the ensuing meeting.

ART. III. Thirty-five (35) members shall constitute a quorum for the transaction of business, but any number of members may adjourn from time to time.

ART. IV. The officers of this Association shall consist of (1) a President; (2) a 1st and (3) 2nd Vice-President; (4) a Secretary and (5) an assistant Secretary appointed by the Secretary; (6) a Treasurer and (7) an Executive Committee to consist of five (5) members to be appointed by the President at each annual meeting, and to whom shall be referred all executive business not otherwise provided for in this Constitution or By-laws.

ART. V. The President, Vice-President, Secretary and Treasurer shall be elected annually at the annual meeting, and shall hold their respective offices for the term of one year. All officers elected by the Association shall hold their respective offices until their successors are duly elected and qualified.

ART. VI. The President shall preside at all meetings, give a casting vote when necessary and perform all other duties that custom and parliamentary usages may require. He may call special meetings at any time, as he may deem necessary.

ART. VII. In case of absence or inability of President to discharge his duties, the latter shall devolve upon the Vice-Presidents in the order of their election.

ART. VIII. The Secretary shall record the minutes and authenticate the proceedings of the Association, and at the close of his term of office shall lay before the Association a full report of his official work.

ART, IX. An Assistant Secretary shall be appointed by the Secretary at each annual meeting.

ART. X. The Treasurer of the Association shall collect all dues and pay all just claims against the Association from the funds of the Association, and he shall keep a record of all receipts and disbursements and at the close of his term of office shall lay before the Association a full report of all matters pertaining to his office.

ART. XI. This Association shall be composed of active, honorary and contributing members.

a. ACTIVE MEMBERS shall consist of any commissioned medical officers of the United States Army, Navy, Marine Hospital Service and National Guard or Volunteer Militia of the United States.

On application and presentation of the proper credentials to the Secretary of the Association, and on payment of the entrance fee they may become active members of this Association and shall retain their membership and rank should they be honorably discharged from the service in which they were commissioned and entitled to wear the uniform of the rank held at the time of discharge from the service upon payment of their annual dues.

Active members shall alone be eligible to office or shall vote at the meetings of the Association.

b. HONORARY MEMBERS shall consist of men who have been in the Medical Service of the National Guard or in the Medical Department of the Regular Army or Navy and Marine Hospital service or in that of the National Homes for Disabled Volunteers or any distinguished military or naval surgeons from any part of the world, who from time to time may be unanimously elected. The names of persons nominated for this honor shall be referred to the Executive Committee on the first day of the annual meeting before they are balloted upon. They shall be entitled to all the privileges of active members, except to the holding of office and voting.

c. CONTRIBUTING MEMBERS.—Any person may become a contributing member who has in any way assisted in furthering the objects of this Association.

Members of this class shall be elected as prescribed for in Art. XI, Section B.

ART. XII. Any member of this Association who may be dismissed from the service for conduct unbecoming an officer and a gentleman, shall when proper proof is furnished the Secretary of this Association, be expelled therefrom and debarred from any further rights or privileges in the Association.

ART. XIII. All voting at regular meetings of this Association shall be by representation; such representation shall be based on one vote each for each State, Territory, Army and Marine Hospital Service, in proportion of one vote for every ten (10) members or fraction thereof, in good standing, present at the time of voting, said vote or votes to be cast by a member or members present from each State, Territory, Army, Navy and Marine Hospital Service designated by the members present from each State, Territory, Army, Navy and Marine Hospital Service.

ART. XIV. The initiation fee of the Association shall be five dollars ($5.00) payable by each active and honorary member, in lieu of the annual dues for the first year. The annual dues shall be five dollars ($5.00) due on the first of January of each year.

ART. XV. No amendment shall be made to this Constitution except by a three-fourths vote of all the members present at any annual meeting.

On motion of Lieut. Clark:

Resolved, That such of the honorary members of this society as are eligible under the Constitution may become active members upon the payment of the initiation fee and annual dues.

Adopted.

On motion of Lieut. Clark:

Resolved, That all re-prints of Maj. Carr's paper now in hands of Secretary and not already disposed of be distributed among new members at the discretion of the Secretary.

Adopted.

A recess was taken until 2 P. M. to convene in the United States Government Building, Jackson Park.

E. Chouellor,

Secretary.

SECOND DAY—AFTERNOON SESSION.

The session was resumed at 2 o'clock P. M. in the United States Government Building, Jackson Park, Chicago, Ills., President Senn in the chair.

Colonel Senn announced that owing to the large number of papers to be read, the time allotted each would be thirty minutes, and discussions thereon not to exceed five minutes.

GUNSHOT WOUNDS OF JOINTS.

By Lieutenant-Colonel H. L. Burrell,
Medical Director Massachusetts Volunteer Militia.

Every surgeon knows that in the past there was a frightful mortality attending gunshot wounds of the joints, and that these injuries usually meant amputation, exceptionally resection. Since the introduction of antiseptics in the few instances in which its principles have been applied there has been great improvement in the results, so far as life is concerned. With the introduction of small-bore rifles, which all the European nations and at last our own government have adopted, must come a reconsideration of the whole treatment of gunshot injuries, and especially those of the joints.

I shall divide this paper into headings, and shall make broad statements in order to elicit discussion. It is written at best on insufficient data, hence the conclusions which I draw are advanced with considerable hesitancy. We can begin with this proposition, which will, I believe, be generally accepted, that we never shall know the full effects of the small-caliber projectile until a war has taken place, and until such a calamity has occurred we must depend upon experimentation and theoretical reasoning.

The headings will be—

1. The effects of the new 30-jacketed projectile upon joints and individual joints.
2. The "firing line" treatment of these injuries.
3. The field hospital treatment.
4. Complications and prognosis.

Under all these headings I shall consider the differences in the injuries inflicted between the .30 and .45-cabiber projectiles.

1. The effect of the new 30-jacketed projectile upon joints.* A most complete series of observations have been made by Capt. Louis

*When the term .30-jacketed projectile is used it is meant to include all the various makes of jacketed lead bullets of .30 caliber, whether covered by steel, nickel or copper.

A. LaGarde, of the U. S. Army, upon "the comparative difference between certain wounds inflicted by the projectiles of the large and small-caliber weapons." I am under the deepest obligations to Capt. LaGarde for the privilege of seeing the specimens of bone injury by these projectiles, and for his permission to make abstracts from his paper, which has not yet been published. It would be more fitting if Capt. LaGarde were to write this paper, as the specimens are unique and very valuable.

Our own Government has finally adopted the Krag-Jorgensen rifle, and the experimentation of Capt. LaGarde was carried out with what is known as the "experimental Springfield rifle of .30 caliber." Its ballistic qualities are quite equal to those of the new Mauser, Leble or Mannlicher rifle. The following is a description of the more important ballistic properties of these weapons as kindly furnished Capt. LaGarde by authority of the Chief of Ordnance, U. S. Army:

"The Springfield rifle, which has formed the armament of our foot troops since 1874, is a .45-caliber gun, the projectile of which has an initial velocity of 1301 f. s. Its projectile is made of compressed lead, cylindro-conoidal, cannelured and lubricated, weighing 500 grains, impressed by 70 grains of black rifle powder.

"The Experimental Springfield rifle is a .30-caliber gun, the projectile of which has an initial velocity of 2000 f. s. Its projectile weighs 220 grains, is made of a German silver jacket filled with a lead core, and it is neither cannelured nor lubricated. It is impressed by 36 grains of smokeless powder."

The velocity and energy of the projectiles of the two weapons at different ranges are as follows:

VELOCITY OF THE PROJECTILES OF THE TWO GUNS.

Name and Caliber of Weapon.	Initial Velocity, f. s.	500 yds.	1000 yds.	1500 yds.	2000 yds.
Springfield, caliber .45....	1301	873	676	531	429
Experimental Springfield, caliber .30.....	2000	1103	804	627	495

ENERGY OF THE PROJECTILES IN FOOT POUNDS.

Name and Caliber of Weapon	Initial Velocity.	Weight, Grains.	Muzzle.	500 yds.	1000 yds.	1500 yds.	2000 yds.
Springfield, caliber .45	1301	500	1879	846	507	313	204
Experimental Springf'd, caliber .30	2000	220	1954	594	315	192	120

"It will be seen by the first table that the initial velocity of the small caliber projectile is far greater than that of the large caliber, and that the striking velocity at all the ranges is greater. The penetrations of bullets are proportional to the squares of their striking velocities. For equal velocities the penetration is proportional to the density of section. The form of the bullet and its power to resist deformation are also concerned in the penetration."

Considerable experimentation has been carried out by German and French observers upon the effect of small caliber jacketed bullets as compared with the soft or hard lead bullets, and all agree in their conclusions. Bruns (2), Noel (3), Delorme (4), Chauvel and Nimier (5), Rogardik (6), Thurnwald (7), and Reger (8), are all men who have contributed to our knowledge. It is interesting to note that the caliber of fire-arms as used in European armies, which was formerly 18 mm., has been reduced to 7 and 5 and 8 mm., and in proportion the weight of the bullet has been reduced from 50 grammes to 15. The rapidity of the bullet has been increased from 400 to 600 meters a second. Experiments upon wood, iron, water and earth have been carried out, and it has been found that the force of the penetration exerted has been increased five or six times, but that the concussion of the bullet has been decreased, and that it causes a wound very like a cylinder, whereas the leaden produced a conically shaped wound, the base of the cone being at the point of exit.

All writers agree upon dividing the effect of bullets into zones. In zone 1, which extends up to 320 meters, the .30-caliber bullet has decided explosive effects,* but less than the .45-caliber.

*The term explosive effects should not be confounded with the action of explosive bullets, but it refers to the action of the bullet upon the tissues with which it comes in contact, especially resistant structures like bone or tissues containing much water, like the brain, enclosed in cavities with rigid walls. LaGarde writes, "When a resistant bone has been hit the foyer of destruction will show great loss of substance; the bone will have been finely communited: the pulverized bone will have been driven not only in the direction in

"Zone 2, which extends from 400 to 800 meters. The bullet produces a wound without any explosive effect. It is cylindrical, and not like the conical wound of zone 1. Bones are perforated and splintered, but retain their form. The effect upon the soft parts is perforative and not especially destructive.

In zone 3, from 800 to 1200 meters, the wound is cylindrical. The wound of entrance is not larger than the projectile; the exit wound is only larger when bone has been traversed. The bones are perforated, but seldom shattered or splintered.

No particular study has been made of the effect of .30-caliber projectiles upon joints by European observers, but reasoning from the effect produced upon bone and the soft tissues and the increased penetrating power of the bullet, the effects upon joints at the various ranges will at times be complex, but usually less destructive than that of the .45-caliber. In a joint we have various densities of bone; we have a closed cavity filled with synovia, which is a capital culture medium for germs.

There will be a great deal of difference between a wound of the knee joint and one of the wrist joint, and it will be of great importance to decide at what range the bullet was fired. It can be readily understood that in a bullet wound of the knee joint bits of the trousers and underclothing may be carried before the bullet, which may lodge within the joint and act as a foreign body. This would not be probable, for instance, in the elbow joint or the ankle joint. These considerations would naturally lead the surgeon to thoroughly explore the joint.

But a striking fact connected with these small caliber projectiles is that in the mid-ranges their great velocity produces a perforative effect, and that not alone upon one man but upon two or three. This was the experience in a number of instances in the Chilian war, Stitt (9), a United States naval surgeon, states that in the St. Augustine Hospital during the Chilian war, of 2000 wounded, that those wounded with the .30-caliber projectile left the hospital a considerable period of time before some 300 of their fellows who had been wounded by the old projectile of over .40-caliber were convalescent. As an

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which the projectile has been traveling, but in all directions, and the pulpification of the soft parts will not only be limited to the track of the bullet, but the utter destruction is noticed some distance into the tissues. The wound of exit appears like a bursting forth of the skin; the track leading to the bone is conical in shape; the base of the cone corresponding to the wound of exit in the skin; and the apex to the seat of fracture. These explosive effects correspond to the velocity of the projectile at the time of impact, and the resistance offered by the part hit."

example of the conservatism which will undoubtedly be the rule in the treatment of joint injuries in a future war, Stitt relates two gunshot injuries of the elbow joint in the San Juan de Dious Hospital; one received from a .45-caliber, the other from a .30-caliber. The injury which resulted from the .45-caliber demanded amputation, whereas that received from the .30-caliber resulted in a moderate synovitis of the joint, which required rest and passive motion a few weeks later.

It is interesting to note that LeGarde's conclusions correspond with those of Continental observers, and he states that "The humane wound of the small-bore rifle is especially observed in the joints and soft parts. Owing to the reduction in caliber the wounds in the latter partake more of the nature of subcutaneous wounds, and experience shows that they heal very kindly under appropriate treatment. It is not necessary in this case to dwell upon the destructive effects of the larger leaden projectiles upon joints. Suffice it to say that the greater frontage which it naturally possesses is made greater still by deformation, and that these facts, with velocity sufficient to penetrate a joint, serve to convert the .45-caliber projectile into a very destructive missive." The following cases noted at Frankfort Arsenal will explain the marked difference in destructive effects by the two projectiles upon the spongy ends of bones:

"No. 1. Gunshot injury of the lower part of the left femur; bullet marked No. 4, caliber .45, impressed by the velocity common at 100 yards, soft parts frozen. The wound of entrance is marked by a V-shaped tear, each side of the V being 2.5 inches in length; the wound of exit is round, 1.5 inches in diameter. It is funnel shaped, the base of the funnel corresponding to the skin, and the apex to the point of destruction in the bone. The soft parts adjacent to the track of the bullet are a pulpified mass mixed with finely pulverized bone. One and a half inches of the external half of the shaft immediately above the articular surface has been carried away; the remaining part of the shaft is separated from the articular surface by a transverse fissure, whilst an oblique fissure extends into the shaft above 2.5 inches in length. The upper and external quadrant of the patella was chipped. There was no fissuring into the joint. The projectile was not recovered.

"No. 2. Gunshot injury of the lower end of the right femur: bullet marked No. 3, caliber .30, impressed by the velocity common at 100 yards. The soft parts were frozen, on account of which the explosive effects were enormous. The projectile entered the femur

just above the epiphyseal junction of the internal condyle and emerged posteriorly in a horizontal line, making an orifice the diameter of the projectile upon entering, and five lines in diameter upon leaving the bone. The perforation is well marked. The track of the bullet in the bone and between the latter and the wound of exit is lined by bony sand. There is a fissure scarcely visible to the naked eye running downwards and from before backwards through the articular surface, separating the two condyles almost equally. There is also a subperiosteal fissure 1.5 inches long, running upwards from the point of emergence in the bone; there are a few small splinters of bone near the wound of exit still attached to the periosteum. The projectile was not deformed.

"That we should find a perforation so well marked in the spongy end of a bone within the range of explosive effects makes the latter case very remarkable. As it is the only recorded instance of a perforation by the small metallic jacketed bullet within the explosive zone, it is but natural to infer that the frozen condition of the soft parts contributed to the result."

The two following injuries illustrate the difference in destructive effects upon the spongy ends of bones entering into the formation of the knee joint at 350 yards:

"No. 4. Gunshot injury of the left tibia and fibula near knee joint; bullet marked No. 5, caliber .30, impressed by the velocity possessed at 350 yards. The wound of entrance is round, of the diameter of the projectile; the wound of exit is marked by a longitudinal slit measuring one-third of an inch. The projectile entered the anterior portion of the head of the tibia, one-third of an inch from the articular surface in the middle line; passing obliquely toward the outer side, it emerged from the posterior surface of the head of the fibula. The orifice of entrance in the bone is equivalent in diameter to the diameter of the projectile; the orifice of exit is irregular, and one-third of an inch in its greatest diameter. There is no comminution. The knee joint was not perforated, but the articular surface adjacent to the tuberosity shows a fissure which was not apparent in the recent state. The projectile was lost.

"No. 5. Gunshot injury of the lower shaft of the right femur, bullet No. 3, caliber .45, impressed at the velocity common at 350 yards. The wound of entrance is 1.5 inches above the outer condyle, round, and equals in diameter the diameter of the projectile. The wound of exit is in the upper part of the popliteal space, irregularly quadrilateral in shape, and three-quarters of an inch in its greatest

diameter. The bullet entered the lower shaft 1.5 inches above the margin of the articular surface, one-third of an inch outside the median line. Nine large splinters are detached, measuring from three to five inches in length. There are a number of deep vertical fissures in the upper and lower fragments; those in the latter do not invade the joint. The projectile was very much set up." Then Captain LaGarde states that "the tendency on the part of the smaller jacketed bullets to perforate the spongy ends of bones increases as the velocity diminishes. After the 500 yards range perforations of these structures are rather the rule than the exception. We made no notes of injury to blood vessels."

So far as I have been able to ascertain there have been no observations upon the effect of the projectiles upon blood vessels, and I fancy that this work should be done.

The "firing line" treatment of these injuries. The theory of the asepticity of a rifle bullet has been exploded by the experimentation of Messner and LaGarde. Messner's (10) experiments were made by shooting a bullet into a tin can filled with sterilized Koch meat peptone-gelatin. "A full charge of powder was exploded. The range was 125 and 250 meters. The conditions were as follows: (1) A non-infected bullet; can sterile. (2) Bullet infected (pure culture); can sterile. (3) Bullet non-infected; can sterile, but covered with a flannel covering which was infected with a known coccus; pure culture."

The results are given thus:

"1. The shot canal through the gelatin showed no change, or more frequently a more or less vigorous growth of 'scheinmelpilz,' or those varieties more commonly found in the air.

"2. Without exception did the gelatin contained in the can show the development of the specific germ with which the bullet was infected.

"3. Here, also, the shot canal was infected with the same germ with which the flannel covering of the can was infected.

"Although the experiments in the third class are not wholly convincing, still enough data is furnished by the rest of the work to decide the question in the negative."

Perhaps the most conclusive proof was furnished by LaGarde, who fired a .45-caliber bullet through a rabbit's ear and infected it with erysipelas, the bullet having been infected with the streplococcus of erysipelas. He also communicated anthrax to three rabbits and one calf by shooting them with projectiles infected with anthrax bacilli.

The wounds of entrance and exit in the .30-caliber in the mid and long ranges are slit-like, and have been compared to what would occur from the entrance of a knife. The skin of every subject of the reception of a gunshot wound is, of course, septic. It is my belief that all that can be done for a patient receiving an injury at the "line of fire" will be:

1. To check the primary hemorrhage by means of tourniquets.

2. To apply an antiseptic dressing (iodoform gauze) or some dry antiseptic. A cartridge shell of .45 caliber might be filled with iodoform and sealed up, and made a part of the permanent equipment of every soldier.

3. To prevent further injury to the patient during his speedy removal to a field hospital.

To summarize, this means that every soldier should have an antiseptic dressing composed of some dry antiseptic which will not need water to render it effective; and that he should have a tourniquet bandage, a suspender, that the company bearer may find his patient equipped for emergency treatment. This work will be done almost entirely by company bearers under the direction of a medical officer. The ambulance corps will be busy in removing the wounded from the "line of fire" to the rear.

3. The field or base hospital treatment. Necessarily with this new projectile, with its increased range of effectiveness, field hospitals will have to be far in the rear. At this point a full equipment and a thorough system for immediate, rapid and accurate treatment of all injuries should exist. This will demand a corps of operating surgeons. The first thing to do in every case will be to wash, shave and sterilize the injured part. This will be done while the anæsthetic is being administered. The limb will then be rendered bloodless by an Esmarch bandage, and the surgeon, with antiseptic precautions, will explore the wound and determine the amount of injury to the parts. He will take into consideration the character of the injury, the projectile producing it, the range at which it was fired, and the length of time that has elapsed since the injury was received. The best treatment of each case will be largely influenced by these considerations.

A gunshot wound of the knee joint from a .30-caliber jacketed projectile in zones 1, 2, and possibly 3, will require a thorough laying open of the joint and its complete cleansing of dirt. A gunshot wound with a .30-caliber in the shoulder joint in zone 1 will mean the mechanical cleansing of the entrance and exit wounds, the irrigating out the bullet track and packing with iodoform gauze. The same in-

jury occurring in zone 3 may mean simply the washing of the external surface of the part, and excision of the wound of entrance and exit, and no interference with the bullet track, but hermetically sealing it with a collodion and cotton (aseptic) or compound tincture of benzoin and iodoform dressing. A gunshot wound of the hip joint by a .30-caliber in zone 1 means a thorcugh cleansing of the wound to its bottom, if possible, and tamponading it with iodoform gauze.

But I feel sure that the rule will be to explore where there is any doubt of the cleanliness of the joint cavity. Plaster of Paris will enter largely into the treatment of joint injuries in future campaigns. Fenestra will be cut, and the wound dressed as often as circumstances demand.

Complications and prognosis. Complications in the treatment of these joint injuries will naturally arise, and they will have to be treated by the general rules of surgery. On the whole, there will probably be a greater mortality from the new .30-caliber than formerly, for not alone will a larger number of combatants be injured, but a greater number will die from primary hemorrhage. But to speak of the prognosis of joint injuries from the new .30-caliber projectile, it would seem as if not only would the ratio of mortality be greatly decreased, but the number of limbs saved and restored to usefulness would be very large. The simply cylindrical-bored wound of the new .30-caliber projectile through the ankle joint, if rendered clean, must be a far less serious affair than the conoidal-smashing wound of the .45-caliber bullet.

The conclusions that may be formulated as regards gunshot wounds of the joints with the new .30-caliber projectile are as follows:

1. That joints having large synovial cavities will have to be thoroughly explored and cleansed, except possibly where the injury has been received at mid and long range.

2. That small or superficial joints with small synovial areas will simply require cleansing or tamponading.

3. That it will require a larger number of company bearers, Red Cross workers and surgeons than have ever been assigned for duty.

4. That so far as joint injuries are concerned the new .30-caliber is more humane than the .45-caliber bullet.

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GUNSHOT INJURIES INFLICTED BY THE MANTLE PROJECTILES.

By Capt. Louis A. LaGarde,
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With the introduction of the modern rifle of small caliber in 1886 the subject of gunshot wounds received renewed interest for the military surgeon at least. The study of the advantages to be obtained by a reduction in caliber and the use of projectiles of hard exterior dates from the publication of a pamphlet by Professor Hebler, a German artillery scientist, in 1882. Since that time the foreign governments one after the other have adopted the small bore weapon, and these are all of the repeating pattern with the exception of the weapons adopted by Russia and Italy—the latter countries having adopted single loaders.

We are indebted to military surgeons from nearly all the governments which have adopted the new armament for valuable experiments touching upon the effects of the projectiles of the different weapons, both upon cadavers and dead and living horses.

In Germany Busch and Reger were among the first to call attention to the difference in destructive effects between the old leaden bullets of large caliber and the new bullets of small caliber with hard envelopes. Later Professors Moresow, Tauber and Pawlow of Russia produced valuable contributions. DeLorme and Chavasse, Chauvel and Nimier especially, in France, pursued the effects of the Lebel projectile on cadavers most thoroughly, and their work will always be prized by those who happen to explore this field of literature henceforth. Bruns in Germany and Habart in Austria have made valuable experiments of late which have served to show in a scientific manner the precise effects of the Mauser and Mannlicher projectiles.

A study of the hand weapons forming the armament of the different European armies shows that, though the guns themselves may vary in their mechanism, the weight and caliber of the projectiles are very much the same. The calibers vary from 6.5 mm. to 8 mm. The velocity and energy of the projectiles differ but little. In fact, the guns and their ammunition are so similar that the ballistic qualities of one gun will answer very nearly for those of another; and we may add also that within certain limits the wounds inflicted by the projectiles are the same.

A study of the effects of the projectiles on cadavers brings out prominently the fact that the amount of destruction is determined by

the same mechanical laws which governed the study of the effects of the older and softer leaden projectiles.

If we look back upon the conditions which influence destructive effects in wounds, we will find prominent among them three factors: (1) velocity of the projectile, (2) resistance on impact, and (3) deformation of the projectile.

It was while bearing these factors in view that the ballisticians predicted the effects of the modern bullet long before it was ever tried, and it was a correct appreciation of these very factors which prompted Longmore to pen the following lines twenty-three years ago. Says Longmore: "The materials of which bullets are composed will influence to a certain extent the nature and character of the wounds caused by them. If bullets of steel, or any similar hard and coherent metal, should ever be found capable of being economically employed in firearms, many of the ordinary features of gunshot wounds, as they at present exist, will be materially changed. In proportion to the increase of hardness and cohesive force of the metals the greater will be the ease with which the brass plates and other accoutrements, the strong bones of the extremities, the vault of the cranium and any resisting structures will be perforated by it. Again, we shall have bullets which will not become softened at ordinary increases of temperature, broken and dispersed in fragments, subject to loss of substance and capable of undergoing the various alterations in form which leaden bullets are apt to assume on coming in collision with certain external objects and hard parts of the body."

When we reflect that the steel mantle projectile is in use to day, and that its penetration, which has excited the wonder of the military world, should depend upon its well-nigh indestructible hardness for the human body, we must read with more admiration than ever the prophetic words of the great surgeon.

If the velocity, the resistance on impact, and the hardness of projectiles were constant, we should find no hesitancy in stating, cæteris paribus, that the destructive effects of projectiles would remain the same.

I believe we can take for granted that the velocity of the different mantle projectiles is about the same. As to the resistance on impact, that also may be considered the same, that is, adult bodies will offer about the same resistance in their different anatomical parts. For instance, the femur of one individual will offer about the same degree, of resistance encountered in the femur of another, and we may take for granted that the calvaria and tibiæ of different subjects will each

offer about the resistance found in corresponding parts of the same or other subjects.

Having determined that the velocity and resistance on impact are pretty constant, what can we say of the third factor concerned in determining the amount of destructive effects, namely, the hardness of the different projectiles? We must assume, in studying the effects of modern projectiles, that penetration with them is determined as formerly by the hardness and coherence of the metals entering into their composition. If all the mantle projectiles were composed of the same metal or metals having equal cohesion, we might expect the deformation to always be the same; but there are great differences found as regards the materials composing the projectiles and their mantles.

The Austrian, French and Russian projectiles are made of hard lead (lead alloyed with antimony), the Belgian and German ones of soft lead. The mantle of the Russian and French projectiles consists of Melchior metal, whilst the mantle of the Austrian projectile is made of nickel-steel; the Germans, Belgians and Turks use nickel-copper-bronze. The nuclei and mantles are all cylindro-conoidal in shape, the former fitting inside the latter. Copper, German silver and cupro-nickeled steel compose the jackets of the mantled projectiles with which we are most familiar in this country. In some recent experiments at Frankford Arsenal the maximum penetration in solid blocks of oak, not thoroughly seasoned, fired across the grain at three feet from the muzzle with a striking velocity of 2000 f. s. the results were found to be as follows:

230 grains copper-covered bullet penetrated.....	4.00 inches.
220 grains German silver-covered bullet penetrated	5.30 inches.
220 grains cupro-nickeled-steel-covered bullet penetrated	19.50 inches.

The copper and German silver-covered projectiles were very much deformed when recovered, whilst the cupro-nickeled steel retained its shape, unaltered. Since the velocity of the projectiles and hardness of the blocks were constant we must attribute the difference in penetration to deformation.

THE COPPER-COVERED PROJECTILE.—The use of the copper mantle has never met with much favor and I believe Portugal and Italy are the only powers that have adopted it with the new armament. Owing to the ease with which it deforms, its penetration as shown in oak is very limited. The yielding nature of the metal renders it necessary to cannelure and lubricate the mantle to prevent deposition of the copper in the steel barrel. The poisonous effects of copper on the

tissues is another objection which has been advanced and some of the writers on the subject have even gone so far as to claim that the use of copper projectiles is contrary to the principles of the St. Petersburg Convention of 1888, "that prohibits the use of arms which would uselessly aggravate the wounds of men placed hors-de-combat, or that would render their death inevitable."

Aside from the supposed poisonous effects of the copper-jacketed projectile when lodged, as a result of irritation by chemical changes; the fact that it is cannelured renders it objectionable in a bacteriological point of view. The increased range and greater penetration of the projectiles of its class render them capable of encountering more recochets than the projectiles of the old armament, and from this we must infer that the cannelures containing the melted lubricant will afford a ready receptacle for the lodgment of dirt, a fact which goes without saying that the danger of conveying the organism of tetanus, malignant œdema and other pyogenic microbes into wounds will be very much increased.

A cannelured lubricated bullet is not only more liable to infection by recochets in transit but it is more difficult to make it aseptic in manufacture and here I have reference, of course, to the greater ease with which septic matter will deposit and remain within the depressions we call cannelures. The heat and the use of acids and alkalies employed in the process of manufacture render the majority of projectiles free from septic germs. It is from this fact, no doubt, that we find so little sepsis in gunshot wounds. Bruns and other observers have advanced the idea that the projectiles from the new armament would surely be made aseptic by the heat generated in the act of firing, the greater friction in the barrel, and the friction against the air. By firing projectiles which had been previously infected with septic germs into sterilized media and animals we were able to show in the Pathological Laboratory of the Johns Hopkins Hospital that this supposed humane phase of the small projectile rested on no foundation in fact. Our experiments which have received publication in part and which we are still pursuing prove beyond any doubt whatsoever that a bullet which contains septic germs when fired carries the septic germs into the wound which it inflicts, and that varying with the susceptibility of the individual hit it is apt to cause sepsis.

German Silver-Covered Projectiles.—Upon comparing the results obtained at Frankford Arsenal with the German silver projectile upon cadavers with those obtained by Bruns with the nickel-steel of the Germans, I am led to believe that the penetration of the

two projectiles is with possible preference for the nickel-steel about the same. The nickel-steel mantle of the Germans is the most yielding of the small caliber projectiles used by the foreign armies.

In our experiments at Frankford Arsenal with the German silver projectiles upon ten cadavers, ten per cent of the mantles parted entirely from the nucleus upon colliding with resistant bone between he 100 and 2000 yards ranges; whilst fifty per cent of the projectiles were more or less flattened at the conical end.

From experiments at relatively short ranges—between 17 to 25 yards—there is reason to believe that separation would take place in every instance of impact against resistant bone. The separation at these relatively short ranges showed destruction of the envelope into many small sharp fragments, stripping of the lead, and complete mushrooming of the nucleus, all of which adds vastly to the explosive effects at short range.

Cupro-nickeled Steel-Covered Projectiles.—As seen by the penetration in oak cupro-nickeled steel offers more resistance than probably any mantle ever tried so far. Although I cannot quote from experiments on cadavers, it is doubtful if this mantle will ever part from its nucleus upon impact against any tissue of the human body, however resistant. If this be true, the addition of the cupro-nickeled steel mantle to the projectile of small caliber will make this the ideal bullet. As long as it possesses momentum its penetration will not be impaired by deformation at least.

The flattening which the conical end of the German silver mantle so often sustains upon colliding with resistant bone impairs its future penetration, and, it may be said, its integrity, for the chances are that upon striking another bone in a second individual as resistant as that traversed in the first, the impaired mantle would rupture, a circumstance which would about arrest its work of destruction in men beyond the second individual hit. We may assume, then, that the fabulous stories told of the penetration of the small caliber projectile, which enables it to traverse four men at 100 yards, can only be true of a projectile like that covered by cupro-nickeled steel, whose penetration and integrity are never impaired by alteration of form. It is evident, then, that any explosive effects to be noticed from the latter will in no way be due to deformation, and that its destructive effects within the explosive zone will be correspondingly less. In a military sense the effectiveness of the cupro-nickeled steel-jacketed projectile will be greater, since it will have penetration sufficient to wound more men; in a surgical sense the projectiles of softer exterior, like those

covered by German silver, will be more destructive, since, upon colliding with the first or second resistant bone, they will be destroyed on impact, and the numerous fragments of the leaden nucleus and shell, each acting as a secondary projectile, will add to the work of destruction in the part hit. For this reason the stopping power of the German silver jacketed projectile will be greater on horses in a charge of cavalry upon foot troops. This statement is not made to disparage the effectiveness of the cupro-nickeled steel-jacketed projectile in this particular, because it is difficult to conceive how such a charge could be successfully made against any armament using the small projectiles of hard exterior, whether deformation is expected or not, but the statement is made to emphasize the fact that those projectiles which are apt to become destroyed on impact increase the explosive effects at close range, hence their superiority in stopping power. The diminution of stopping power in the cupro-nickeled steel has led some of the experimenters to remove a small bit of the conical end of the casing, sufficient to expose the lead, in order to invite deformation on impact. This is an expedient which will doubtless be practised in repelling cavalry, and also by the sportsman in hunting large game. The progress of civilization, so manifest in the use of the new arma, ment, will hardly allow the employment of a projectile more deadly-if anything, than the murderous leaden bullet which we have just discarded, and it is to be hoped that the comity of nations will frown down any attempt to increase the destructive effects of the cupro-nickeled steel bullet in war.

As stated already, of the three factors which determine the amount of destruction in gunshot wounds, namely, velocity, resistance on impact and deformation of the projectile, the first and second are pretty constant. If, now, we employ a mantle of indestructible hardness for the human body, like cupro-nickeled steel, for instance, the third factor will have been made constant; gunshot wounds will be more humane, and the results of observers henceforth will be more uniform.

Are projectiles of hard exterior more humane than those of the old armament?

The answer to this question is, yes. For wounds of the soft parts and epiphyses it is so at all the ranges; for injuries of the diaphyses the humane advantages are only noted beyond the zone of explosive effects.

Will the proportion of hits to shots fired be greater with the new armament? The answer to this question involves many ifs. As the

ballisticians have added sustained energy and penetration to their projectiles, so have the tacticians extended the order of their ranks. The open order of our new drill regulations is the outcome of the excellence of the new armament. The troops are to be so ingeniously arranged in the order of battle henceforth that we need not expect to see a greater proportion of wounded than heretofore, except in those rare instances when certain parts of the line come in close collision at the same time that the troops are massed in compact order. The element of one bullet hitting more than one man can only be properly entertained when we know the disposition of the troops, whether standing unprotected or lying on the ground sheltered by the natural undulations of the field or by earthworks, and, if standing, what the order may be.

Will the proportion of killed to wounded (which statistics so far place as 1 to 4) be disturbed by the use of the new armament? This is a vast subject, and one which can never be correctly answered until we have gathered competent statistical data. One of the chief causes of death on the field of battle is said to arise from fatal primary hemorrhage. Morandy ascribes 75 per cent of deaths to this cause; Legouest states 30 per cent; Lidell places the loss at 18 per cent. These figures are founded on mere assumption, because, as a rule, the surgeons are so busy in caring for the wounded after a battle that there is no time to devote to the dead, hence the lack of precise data.

With the use of the new armament I believe the cases of fatal primary hemorrhage will be less. In making this statement I am mindful of the fact that the majority of the writers on this subject entertain the opposite view. I have based my convictions upon the following mode of reasoning: When the leaden projectile encounters resistant bone, pieces of lead are nearly always detached at the moment of impact. If the momentum of the projectile is still sufficient, the pieces of lead and detached splinters of bone act as secondary projectiles, and the danger to neighboring vessels is consequently increased. Since the new projectiles beyond the zone of explosive effects cause less shattering, and as they seldom deform, the amount of danger to blood vessels will not be so great; hence the percentage of fatal primary hemorrhage in future wars should be less.

WOUNDS MADE BY LARGE AND SMALL BULLETS.

A Digest of the Past Experience Compared to Experiments Recently Made on the Effects of the Small-Caliber Infantry Arm.

By Major Alfred C. Girard, Surgeon U. S. A.

In selecting for consideration at this meeting the bearing upon military surgery of the great changes wrought by the revolution in the armament of nearly all the civilized nations, your President, always in the front rank of investigation and progress, has conferred a great boon upon the profession.

Up to the present time numerous experimentors of no mean reputation have singly devoted their time and skill to determine what effect, if any, the change from large-caliber guns of relatively slow velocity to the small caliber with higher velocity will have upon the military surgery of the future. These experiments generally have been published to the world, and were accepted for what they appeared to be worth, according to the professional standing of the author or the plausibility of his arguments. No congress of scientists or jury of surgeons has undertaken the task of sifting the gold from the dross, and the various views are waiting for the scrutiny of a court of professional peers to either give them a standing among accepted scientific facts or relegate them to the rubbish pile composed of the many one-sided efforts of the human mind which have swelled the catalogues of our libraries and encumbered the pages of our journals.

The eminently practical master mind of your President recognized the fact that the time has come when such action is expedient. Neither he nor any one else of common sense will pretend that the investigation of this subject is closed and that a just and correct verdict may be rendered. But it is true that a consideration by a number of educated men, whose minds are not blinded by belief in some theory, will to a certain extent clear away the rubbish and indicate the true path of investigation.

With keen foresight your President has come to the conclusion that this assembly at its first meeting in the history of the nation, composed of surgeons from all parts of the country—many having witnessed the horrors resulting from wounds inflicted upon the human frame by firearms—all interested in the progress of knowledge "pari passu" with the never-ending changes in the material of war, would set the example for a dispassionate, disinterested scrutiny of facts as they are at the present time before us. We may possibly attain but slight additional light in the domain of surgery, and our finding will

not influence the question of peace or war. We meet a change in the weapon, and will simply have to consider the question, "What bearing will it have on the character and consequences of the wounds inflicted?"

The subject of this paper is not one of my choosing; it is assigned to me by your President, who, knowing my willingness to work in our common cause, and, I hope, not overrating my ability, has imposed upon me a task which the more I penetrated into the mysteries of ballistics the more it became bewildering. After being convinced by the apparent correctness and plausibility by one set of experiments, my views were modified by another working in a different direction, and these again by the next, each leaving certain impressions and effacing others, until I finally have come to a conclusion quite different from the one which I expected to advocate.

But I will not anticipate.

This paper is not expected to treat of special wounds on special tissues or special parts of the human frame, but more of the elements at work in the various methods of disabling the foe, leaving special consideration to the authors of other papers, which we will listen to at this meeting. Since, however, the results of gunshot injuries are the more aggravated as the missiles meet resistance in the human body, the more serious effects will naturally receive the greater part of our attention.

A short rehearsal of the evolution in small arms will be a fitting preface and make those of you who have not given the question special attention acquainted with the weapons and projectiles the effect of which we desire to investigate.

Up to the time of the Crimean war the small arms of the infantry of all armies were smooth-bore, with spherical bullets. From that time dates the more general introduction of the rifled barrel, which the allied armies used in the siege of Sebastopol. Their Minie gun, however, had even a larger bore, 18 mm. (0.71-inch), and a heavier conical projectile weighing from 40 to 50 gramm. (600 to 700 grains). The wounds inflicted by this weapon, and the distance at which it was effective, caused great astonishment and consternation among the Russian surgeons.

About the time of the Danish war Prussia introduced the needle-gun with a reduced caliber, and its example was followed by most of the European nations, the general average caliber being from 13 to 15 mm. (0.51 to 0.59 inch).

In 1866 France adopted the Chassepot with a caliber of 11 mm. (0.43 inch), and weight of the elongated bullet 25 grm. (375 grains), increasing the powder charge, thereby obtaining a flatter trajectory, greater velocity, greater range and more power of penetration. The tactical result was that the German troops found themselves under fire beyond the range of their needle-gun; the effects, as far as the class of injuries was concerned, were as a rule a lesser gravity of the wounds, with at times, however, astonishingly destructive results.

It then became necessary to devise a weapon which not only would have the desirable range, trajectory and penetration, but would enable the soldier to carry a sufficient supply of ammunition, which, owing to the greater simplicity of the mechanism of the gun and the increased distance at which firing was begun, was a very important question.

This led during the last ten years to a still further reduction of caliber, together with the introduction of slow-burning powder of enormous propulsive power.

Then in France the Lebel rifle was finally adopted, after gradual experimental reduction of the caliber to 8 mm. (0.31 inch). Austria introduced the "modified Mannlicher" with the same caliber, Switzerland the "Rubin-Schmidt," with 7.5 mm.; Belgium, the "Mauser," of the same caliber, and finally the United States Army has cast its verdict in favor of the "Krag-Jorgensen," or Model of 1892, with 7.5 mm., or .30 caliber.

As to the material of the projectiles, lead has continued the component in the large calibers. The alloying with it of harder metals has been found to injure the rifling, but it became necessary to insure the stability of the shape of the pencil-like bullet of the smallest calibers, and in order to protect the rifling the metal was enclosed in a jacket of soft steel, brass, copper or nickel, while the core was what is called "hard lead," or a mixture of 95 per cent lead with 5 per cent antimony.

Thus as we reach the small bullets, we find them of a harder, more resisting material, less liable to undergo the deformity of the pure lead bullets of larger caliber.

As to shape, as seen above, the bullet of the Minie rifle was conical, increased in length and correspondingly in weight in the needle gun, and finally reached in the small calibers a length several times its diameter in order to preserve a momentum corresponding to its velocity.

Since in our study of the relative effects of the various calibers, we naturally have to consider the properties imparted by velocity and energy of the projectiles, I select as prototypes our own .45-caliber Springfield rifle for the large caliber, and for the modern small projectile the Krag-Jorgensen. The minor variations of other weapons are of no importance from a surgical point of view. The data are obtained from a report of Dr. LaGarde, of the Army, and originate from the Ordnance Department of the Army. Thus we have for the .45 caliber at the muzzle an initial velocity of 1300 feet, at 500 yards 873, at 1000 yards 676, at 1500 yards 531, at 2500 yards 429, with a bullet of 500 grains: while for the Krag-Jorgensen, with a bullet of 220 grains, we find an initial velocity of 2000 feet, and for the other distances respectively of 1103, 804, 627 and 495, or an increase velocity in favor of the smaller bullet of 699 feet at the muzzle, and respectively at the other distances of 230, 128, 96 and 66 ft., showing that the smaller caliber has a greater velocity at all ranges, but especially an enormously increased initial velocity.

As to the energy, we find for the .45 caliber at the above mentioned ranges an energy of 1879, 346, 507, 313, 204 foot pounds; while for the smaller caliber the corresponding energy is 1954, 594, 315, 190 and 120, or an increased energy up to 1500 yards, and thence a lessened one.

A few points on the physics of ballistics will, if I manage to be clear enough in applying this difficult branch of mathematics to our subject, enable us to more clearly appreciate the value of the experiments with the small caliber weapon compared to our actual experience in the effects produced by the large bullet.

The projectile, after being expelled from the barrel by the explosion of the charge, acquires a certain power of penetration—a live energy—and on coming in contact with resisting surfaces perforates them, providing it is of sufficiently solid material to overcome the resistance, or else its molecules are not adherent enough in proportion to the energy of propulsion and it is deformed. There are consequently two factors in play: The energy of the projectile and the cohesion of its molecules. When the resistance is greater than the cohesion and the projectile is deformed, the remainder of the energy is expended in concussion and creation of heat.

Other factors have been advanced as components of the effect of small arm projectiles and will be mentioned here in order to be disposed of according to their merits.

It has been alleged that the air propelled by the bullet in its flight had an important office in the character of the injury inflicted and its presence in comminuted tissue was adduced as a proof of this theory. This is evidently erroneous, especially for the conical bullet, as by its very shape it is more fitted to separate the strata of air in its flight, and the presence of air after dissection of a wound may naturally be ascribed to entrance after an injury, at least not preceding it, the more so, as the resistance of the tissues is so much greater than unconfined air.

Some authors tried to prove its existence as a factor by the appearance of air bubbles on the surface of the water when a rifle is discharged into it. Some have tried to disprove this theory by explaining the presence of the bubbles as the result of accidental injury to fish bubbles or the aggregation of air vesicles mechanically mixed with the water owing to the concussion, all of which appears far fetched. The simplest explanation appears to me to be that as nature does not tolerate a vacuum and the water does not close as rapidly behind the bullet as the channel created is formed, the air following in the wake of the projectile rushed into it and then by reason of its lesser weight rises to the surface.

I believe this disposes of the air theory as a factor in gunshot injuries.

It has also been claimed that the powder gases affect the wounds formed by projectiles from firearms. It has, however, been proven by conclusive experiments that they have no effect whatever at a distance of fifteen feet from the muzzle, when they produce no motion in a suspended piece of paper.

The rotary motion imparted to the bullet by the rifling of the gun barrel has been by some authors considered an important factor in its power of penetration. This may, however, be set aside, or considered a very minor element, if we remember that the flight of the bullet during one rotation exceed sixteen inches, while its impact on a bone rarely is more than a fraction of an inch, the more so, as bullets of smooth-bore muskets, consequently without rotation and at close range and having similar volocity and energy, produce penetrating results identical with those from rifled weapons.

The projectile itself, its density, weight, diameter, shape, size, length, is of great moment in considering its effects, and these are changed by various causes. The elongated bullet may ricochet and on striking instead of its point present its side. A large projectile impelled by a weak charge may have a lesser effect than a smaller

bullet driven by a strong charge. The form of the projectile may be changed on impact and this change becomes an important factor in the character of injury produced. This is principally due to the metal of which the bullet is composed and the manner in which it is prepared. Bullets made of soft, pliable lead on meeting with considerable resistance assume a change of shape depending on the force of the impact, its angle and the texture of the resisting body. The projectile is flattened, twisted, inverted, ragged, incised, assuming all sorts of grotesque shapes. This is the condition of affairs we meet in the use of large bullets, which, as mentioned above, are composed of soft lead.

Bullets made of hard lead, or covered with jackets, as will be seen hereafter, may be affected in a similar manner, but require a much greater resistance to bring about a change in their shape, hence the perforations resulting are generally of nearly the same diameter as the bullet.

Thus far we have reviewed the simple perforating effects of small-arm projectiles, and this may be the proper place to treat of their so-called explosive effect. The name has been applied on account of the results following the use of solid bullets, inflicting wounds at certain ranges and under certain circumstances, which wounds are identical in aspect with those made by an explosive bullet. To explain more fully: "A small entrance aperture in the skin, an enormous destruction taking place as soon as the projectile strikes a bone, producing, in addition to the actual bone wound channel, a pulpification of the tissues to the size of one's fist, with a greatly increased opening of exit than would seem consistent with the size of the bullet."

The resemblance of the two is not, however, complete, for it is found that wounds produced by hollow bullets charged with an explosive usually have no exit.

The following is to me the most plausible philosophy of this remarkable effect:

On leaving the barrel the whole body of the bullet attains a forward movement, which continues either until its energy is exhausted and the gravity predominates, or until it is arrested by an obstacle. In the latter case, if the impact is strong enough, the bullet will perforate with more or less injury. If the resistance of the obstacle is equal to the cohesion of the projectile, perforation will still take place; but as the center of the bullet succumbs to the arrest of its velocity, its circumference, being in a peripheral direction of lesser cohesion, will expand more or less, causing destruction at right angles to the trajec-

tory. If the resistance is sufficient to almost entirely or absolutely arrest the bullet, this centrifugal effect will become more pronounced and in direct ratio to the density of the surrounding structures. This effect will be shown by an actual deformation of the projectile (if of soft lead); the base or center of the bullet, losing its velocity last, continues its forward movement, while the point is arrested and the peripheral parts are forced asunder, thus either producing a flattening of the bullet with its base in the center, or they are actually separated from the base and fly in every direction through the tissues, causing an appearance of explosive effect, which, during the Franco-Prussian war, led to actual incrimination of the French for violation of the article in the Geneva convention against the use of explosive bullets.

Formerly these shreds of lead were considered a result of fusion of the bullet either by the heat imparted by the charge or transformation of velocity with deformation with concomitant production of great heat. The black edges of the wound added to this belief in the effect of heat and the iridescent appearance of the bullet seemed to confirm it. But this theory has received its death-blow principally by the experiments of von Beck, who has shown by direct thermomitric observation that a leaden bullet does not acquire a higher temperature than 69° C. (156° F.), one with a steel jacket 78° C. (172° F.), and one with a copper jacket, the best conductor of heat of the three, 110° C. (230° F.), while the point of fusion of lead is 334° C. (633° F.), and that of steel and copper immeasurably higher. Besides, it would take a higher temperature than even the highest of these to char the edges of a wound.

Another argument against the alleged heat effects of projectiles has been furnished by the interesting experiments of LaGarde, who has shown that cultures of various bacilli inoculated on the bullets which were fired into suitable animals or media, kept their vitality and produced infection, which certainly would not happen if the bullets were heated to the point of scorching the wound channels, much less if the bullet attained the fusion point of lead. Still, this argument can not be absolutely conclusive, as the bullets were fired with reduced charges.

Microscopic examination of the back edging of bullet wounds has shown that it is due to powder mixed with lead dust and the lubricant, which are wiped off the bullet on its penetrating, and its iridescent appearance is not due to fusion, but to a deposit of lead sulphide

resulting from the chemical action of the powder on the lead at the moment of combustion of the charge.

This disposes of the question of heat in gunshot wounds and its relation to explosive effects.

I have tried to explain these effects by the deformation of soft lead bullets on striking certain degrees of resistance, and this is no doubt the main factor in projectiles of relatively soft composition.

This explanation will not, however, apply to the explosive effect resulting, according to most experiments, from the impact of the modern small calibre bullet at certain ranges, as this projectile, owing to its protecting jacket, meets enormous resistance without deformation.

We have, therefore, to seek for another explanation, which would apply to the two in common.

The experiments of Reger and Casher principally have led these eminent investigators to come to the conclusion that the explosive effect of bullets is the result of hydraulic pressure, which they have even tried to prove by manometric measurement. Such hydraulic pressure may come into play in gunshot wounds of parts containing a large percentage of liquid, such as the brain, lungs, heart, liver, spleen, bladder and even, assuming the more or less liquid marrow, to come under the law of hydraulics—the long bones—but it will not explain the effects on dead tissues and on bones from which the marrow has been removed, when a similar explosive effect has been observed without the possibility of considering hydraulic pressure as a factor.

As we go further, we will find that most experimenters with the modern small arm, of course with reduced charges and computed ranges, agree that the explosive effect of the small bullet does not reach beyond the distance of 350 yards, while for the large caliber projectile it passes 1500 yards. This may supply us with a clew if we compare these results with the energy tables of the several calibers, providing no mistakes have been committed in the mutual relation of of the full size bullet and natural resistance of bone to the reduced charge and distance, all of which may be mathematically correct and in accordance with accepted ballistic laws.

On examining this table we find that the highest velocity of the small caliber bullet is in its so-called explosive zone, and that its energy, which depends on the weight as well as on the velocity, is greatest in that zone and decreases thereafter as compared with the relations of velocity and energy in the large-caliber bullet, where

velocity is impeded by diameter and energy increased by weight. The conclusion is that on striking the bone squarely (which is one of the conditions of explosive action) it inflicts such enormously rapid and intense pressure that perforation or yielding of the bone to the advance of the projectile is not rapid enough to allow its passage with unimpaired momentum, but a small part of this is active by lateral pressure, thus disintegrating the bone at right angles to the line of impact. The power of resistance being greatest in the longest diameter of the bone and equal throughout its extent, we find that in long bones the fractures extend from one end to the other, and in flat bones, such as the skull, in every direction from the point of impact.

The natural conclusion is that the most destructive effect of either caliber is due to a lateral vibration or concussion in the zone of the greatest energy, at least the explanation seems more rational than that of heat, air, gasses. or hydraulic effect.

The fact that in large-caliber bullets the explosive zone is so much greater can easily be explained by the deformation on impact, which adds to the destructiveness of the cross section.

It would be interesting and perhaps prove conclusively the relation of deformation to energy, if experiments were made placing the old large caliber and the modern small caliber on an equal footing as far as deformation is concerned, by incasing large-caliber bullets of hard lead in a metallic jacket.

I believe it would then be found that the so-called explosive zone of the large caliber would be shortened, and be to that of the smaller caliber in direct proportion to the energy plus difference in cross section.

In the consideration of the effect which range has on the wounds inflicted by small-arm missiles, the generally accepted division introduced by Bruns into zones may be adopted here, bearing in mind that barring the observations of the Chilian war, when for the first time the .30-caliber rifle was used in actual warfare, the data are almost entirely experimental. I had at my disposal a hospital report of the Chilian army, and found that the results did not differ from those obtained by experiments, but the important factor of range was lacking for a proper classification.

Bruns divides the stages of flight of a bullet as far as its effect is concerned into four zones: An explosive zone, one of intense energy, one of energy and one of decreasing energy. The first, or explosive zone, according to Bruns, extends with the small-caliber projectile to 400.500 meters. It exists only for resisting surfaces, either

of brittle textures, as bones or liquid or semi-liquid contents, as liver, spleen or bladder. With the large-caliber bullet we have seen that its explosive range is much greater, being doubtless affected by the increased diameter and deformation. The wound of entrance may be small, enlarges as more resisting tissues are met, until finally the bone developes the apparent explosive effect, with great destruction of tissue to a considerable distance around the point of impact. The fracture in the bone radiates in every possible direction, periosteum is separated from the fragments, spiculæ are driven into the adjoining muscles, the cavity is filled with pulverized bone. The wound channel is funnel-shaped with the apex towards the entrance. The wound of exit, greatly enlarged, exhibits ragged ends of muscles, tendons and fasciæ.

According to the experiments, the explosive action is less severe in wounds by small-caliber bullets. The splintering and fissuring does not extend beyond one-fourth or one-third of the length of the diaphysis, while with the deformed leaden bullets of large caliber, more than half of the bone is comminuted and the fissures extend its whole length. In the former the splinters of bone are held more or less together by the periosteum, while the splinters from the large bullet are entirely stripped and scattered among the surrounding tissues. The size of the cavity formed by comminution is smaller as a rule in small-caliber wounds. The great difference, however, between large and small-caliber wounds consists in the frequent arrest of the former, while the small bullet, in experimental shots, perforated as many as four or five bodies and comminuted the strongest bones three times.

The wounds of the soft parts correspond in this zone to the size of the bullet and do not greatly differ, except that, as mentioned above, owing to the smaller velocity of the large bullet and its easy deformation by any deflecting object, it readily loses its energy or causes lamation.

The seeond zone is that of intense energy. Its limit is about 1000 yards with remaining velocity in the large bullet of about 676 feet, while the smaller bullet shows one of over 800 feet. In this zone we find the greatest difference between the effects of the two projectiles; while the large caliber, in striking bones, still is deformed and causes extensive fractures; the smaller bullet, according to the experiments with reduced distance and charge, passes through the epiphyses without any other appreciable injury but the passage forced by the bullet, and only in striking the diaphysis will fracture result beyond the place of immediate impact. Some glancing shots of the larger bullets will

extensively splinter the bone, while the smaller one punches out a groove generally with only a few small fissures.

The remarks applied to the wounds of the soft parts of the first zone are equally correct for the second.

This zone will generally be the one in which troops are placed under fire, and if the experiments are borne out in practice, it is a fortunate coincidence that the charges brought about by the needs of the present system of warfare, while increasing the accuracy of the fire, perform the slaughter in a relatively humane manner, placing perhaps a larger number at a greater range *hors de combat*, without, however, inflicting the terrible lesions of the older weapons, which maimed for lifetime and burdened the state with numberless cripples.

The third zone, with the limit of 1500 yards, again approaches more the effect of the first and of the larger caliber projectile; owing to the lessened energy of the small caliber bullet its perforations are not as clean, the effects of contusion are more visible, fractures entered in various directions, the soft parts are lacerated; but still, unlike the larger bullet, it is not arrested in the tissues, and will, after passing through a body, comminuting bones, speed on after more victims.

The fourth zone is that of the exhausted energy, or the result of glancing, and all bullets have at this time the peculiarity of losing their horizontal impact, and reach the body under all sorts of angles, causing either simple contusions or fractures with extensive lacerations of the soft parts.

In conclusion I desire to remark that I have given a relatively large share of this paper to the physics of gunshot wounds, for the reason that I considered it merely introductory to a detailed consideration of the various tissues and parts of the body, and deemed a review of this part of great importance to correct investigation.

I was the more impelled to adopt this course because, as repeatedly mentioned in this paper, wounds inflicted by large-caliber bullets are well known to the profession, for whom this paper is intended, and the knowledge of injuries by small-caliber bullets rests almost entirely on experiments with reduced charge and computed distance.

I have, all through my study of the subject, had an impression that there was a flaw in these experiments, and I have not only consulted works on ballistics, but persons well informed on the subject, without being able to discover it. The formula for the computation of energy and English works seems copied from French investigations and generally accepted as a law of nature. If there is a flaw it will be found in this formula and in the fact that the relation between the different

velocities is a geometrical and not an arithmetical one. By simply reasoning I have, as mentioned above, arrived at the conclusion that the energy of a projectile is the main factor controlling the amount of injury inflicted, and if the formula for energy is not correctly applied the whole fabric of the conclusions drawn from the experiments with reduced charge and computed distance is fallacious.

I was so much impressed with this view that I have not accepted anything in these experiments as fact, and curtailed the relation of the results achieved as much as was compatible with the treatment of the subject assigned to me.

A strange occurence after the completion of this paper appears to confirm the doubts held as to humane effects of the change of caliber.

A medical officer of the Prussian Medical Staff, on duty in the War Department in Berlin, sent to this country by his Government, visited my post, Fort Sheridan, a few days ago. The thoughts about my paper were naturally predominant in my mind, and I engaged him in conversation on the subject. He told me a thunderbolt was about to strike the experimental results on the new small-caliber weapon—that experiments had been made lately, just before his departure, by a commission of experts with actual charges and distances, and that the effects were, if anything, more destructive than those of the large-caliber guns. The report of the commission was not completed at his departure, and he seemed rather disinclined to divulge more.

It behooves, us, therefore, not to accept these experimental results, which seem to predict a revolution in military surgery, in too sanguine a manner, and before committing ourselves to positive conclusions to await the reports of these latest investigations.

By being conservative we may possibly not be in the advance of progress, but will escape the mortification of having to retract.

THE MILITARY RIFLE.

By Lieut. G. D. DeShon.

Assistant Surgeon, United States Army.

In connection with a study of the changes produced by the modern military small-arm in the character of gunshot injuries it may be of interest to the surgeon to note briefly the changes undergone by the weapon itself, with the causes leading thereto.

The first appearance of hand-guns, or hand-cannon, as they were called, was in the fourteenth century. They were so heavy that they

were rested upon a crutch, and were touched off by a slow match held in the hand, the recoil being received by the breastplate instead of the shoulder. These were soon followed by the matchlocks, which had a swinging cock to hold the slow match, and were fired by forcing the cock, with its lighted match, down against the firing pan. After nearly two centuries of use these were in turn followed by the wheel-locks—a complicated device for pressing a piece of flint against a revolving steel wheel placed under the pan. All of these early fire-arms were so slow to load that they could be fired but once an hour. The flint-lock proper was introduced into the French army in 1680 and continued to be used by all armies until 1842, when replaced by the percussion locks, although in our own army, owing to an insufficient supply of percussion locks, the flint-lock continued in use for some years longer. Indeed, the Mexican war was fought principally with the flint-lock musket. The percussion musket introduced about this time was a smooth-bore, muzzle-loading weapon of caliber .69, which fired either buckshot or a round ball or both together. The charge of powder weighed 110 grains and was contained in a paper shell. The effective range of this weapon was 200 yards and it could be fired at the rate of twice per minute.

Thus far improvement had been principally in the mechanism for igniting the charge. It now began to be noticed that there was great waste of energy on explosion, due to the imperfect fit between the ball and the interior of the barrel. To remedy this the inner surface of the barrel was grooved and the spherical projectile exchanged for the conoidal bullet. This gave greater exactness of fit between barrel and bullet, with consequent less loss of energy on explosion, greater initial velocity to projectile, and hence increased range. The new conoidal bullet, however, did not give as great an increase in range as was expected, and this was discovered to be due to its turning in its flight about its shorter axis, or "wobbling," thus presenting its greatest surface to the resistance of the air. To prevent this and keep the projectile end on in its flight, a motion of rotation about its long axis was imparted to it by giving to the grooves on the inner surface of the barrel a spiral twist, and to still further diminish resistance the caliber was at the same time reduced. These principles brought forth the "Rifle," first issued to our army in 1855 in the form of the Springfield muzzle-loading rifle musket, caliber .58. The paper cartridge was still used, but the charge of powder, it was found, could be cut down to 80 grains. This was the weapon of the Civil War, though the troops

were supplied with others of different patterns, some, unfortunately of different calibers, necessitating different ammunition.

To increase the rapidity of fire, loading by the breech was introduced in England during the reign of Henry VIII., but the mechanism was so clumsy that little use was made of it until the present century. In 1818 our army was supplied with a breechloading flint-lock in which the chamber piece, hinged at rear in the line of the barrel, could be tilted up and a paper cartridge inserted in its front end. A catch underneath held the chamber down when closed. The loss of gas was so great, however, that the use of this gun was not continued. Experiments were made with other models from time to time, as the Sharp, the Spencer and the Maynard, which latter was the first to use the metallic cartridge. But not until 1866—after the brilliant success of the Prussian needle-gun in the Austro-Prussian war—was the breechloader made the regulation weapon of the United States Army. Acting upon the same principle as in 1855, the caliber was reduced to .50. In 1873 the caliber was further cut down to .45, and the Springfield rifle adopted, so well known to us all, with its charge of .70 grains, its bullet of 500 grains, its initial velocity of 1301 feet per second, and its range of 2000 yards.

Attempts to still further increase the rapidity of fire led to the introduction of magazine rifles. With the increased expenditure of ammunition required by these repeaters a greater number of rounds had to be carried by the soldier, and, in order for this to be done, the weight of each round was decreased by reducing to the minimum its caliber; the limit, which was found to be .29, being the difficulty in manufacturing so small a barrel and in keeping it clean after firing. This fouling by gunpowder led to the invention of smokeless powder, which also gave a greater initial velocity. To keep this slender bullet with its highly-increased initial velocity point on in its flight required an increased rate of rotation, so a sharper twist was given to the rifling, *i. e.*, one turn in nine or ten inches, with a velocity of rotation of 2000 turns per second, instead of one turn in 22 inches with a velocity of rotation of 800 turns per second, as in the Springfield .45. The lead bullet had been used thus far, and to give greater penetration had been gradually hardened by alloying with antimony; but it would not follow this increased twist, and would strip; hence sheathing with some harder metal, as copper, steel or nickel, became necessary.

The above outlines briefly the evolution of the modern military small-arm, with its small caliber, its jacketed bullet and its magazine action. The advantages of the small-caliber weapon other than those

already mentioned are, (1) diminished recoil, (2) less deviation by wind, (3) flatter trajectory with consequent increased dangerous space, (4) greater penetration, (5) greater accuracy, due to flatter trajectory and less change of elevation at different ranges, and (6) more humane wound.

The advantage of magazine action is self-evident, but it also has its disadvantage in causing great waste of ammunition in the hands of raw troops under the excitement of their first campaign.

Magazine rifles may be classed according to variety and position of magazine, as (1) tubular under barrel, (2) tubular under butt of stock, (3) detachable under receiver, and (4) fixed under receiver. Tubular magazine guns present the disadvantage of being inconvenient to load and of having the position of the center of gravity changed by the changing number of cartridges in the magazine, thus preventing good marksmanship. The cartridges also may jam or even explode in the magazine. The magazine in butt weakens the stock, and has not been adopted by any military power. The tubular magazine under barrel is used by Portugal and Japan. The Portuguese rifle is the Kropatschek, caliber .315. Its barrel is 32.3 inches long. Its bullet weighs 245 grains, its charge 70 grains of black powder. Its magazine holds eight cartridges end to end. A spring attached to the forward part of the magazine presses against the cartridges, throwing them one at a time into a carrier or trough situated under the receiver. The bolt is pulled back, raising the carrier, so that in closing again the bolt strikes the base of the cartridge and forces it into the chamber, the carrier being at the same time forced down and taking in another cartridge. The Japanese rifle is the Murata, caliber .315. In general arrangement it resembles the Kropatschek, but differs from it in the greater ease with which its bolt can be removed from the piece, and also in having a lock for the firing-pin which prevents premature discharge. Both these guns are provided with cut-offs and can be used as single-loaders.

Guns with detachable magazine present the advantages of simplicity of mechanism and fixed position of center of gravity, and the disadvantage of liability of magazine to become deformed or lost, thus making the gun virtually a single-loader. Guns of this type are used by Austria and England. The Austrian gun is the Maennlicher, caliber .315. It is a bolt gun, in which the bolt is operated by a single backward and forward movement of the hand, all other military bolt guns requiring the bolt to be turned to secure it after closing or to unlock it for opening. The piece can be readily fired without removing it from the shoulder. The magazine is under the receiver,

and to fill it the bolt must be drawn back. A special feed-case packed ready for issue is used, which is made of tin, weighs the same as a single cartridge and costs about two cents. It holds five cartridges by their flange ends only. The top one alone can move forward. The loaded case is inserted from above into the magazine, a spring in the magazine acting through the case on the cartridges. The empty case is thrown out automatically when its cartridges have been fired. This gun gives perfect control over the number of cartridges fired, as the use of packages can be readily observed, but it can not be used as a single-loader, which is often desirable, as no magazine system allows refilling as rapidly as a single shot can be put in, and the soldier would be at a disadvantage when his magazine was emptied if he must needs wait till the magazine was filled again. He should be able to fill his magazine by putting in cartridges one at a time or all together, and do either with his gun loaded or not.

The English gun is the Lee-Speed, caliber .303. It is a bolt gun with an opening the length of a cartridge in the bottom of the receiver, just back of the barrel. A detachable magazine is inserted from below. Several of these magazines are carried in the belt, each provided with a spring and follower within to force the cartridge up into the receiver. These magazines are filled by the soldier and used over and over again. When a magazine attached to a gun becomes empty it is dropped by pressing a spring and another magazine is inserted in its place. A cut-off is provided so that the gun can be used as a single-loader. The bolt of this gun can be removed with the greatest ease.

Guns with fixed magazine under receiver have been adopted by Germany, France, Denmark, Belgium, Switzerland, Italy, Russia and Spain, and recently by the United States. Probably the best of this class in use among foreign powers is the German service rifle—the new Mauser, caliber .301. The magazine is directly under the receiver and holds five cartridges. The breech-bolt being drawn back and the receiver exposed, the cartridges are inserted from above into the magazine by means of a tin feeder, from which they are released by pressure on a spring within, the feeder being then thrown away. The bolt in closing lifts the uppermost cartridge and presses it forward into the chamber. A spring in the bottom of the magazine keeps the cartridges pressed constantly upward, so that they come readily into the receiver in succession. Should this spring get out of order the cartridges would remain in the magazine and prevent further use of the piece as a repeater. A cut-off enables this rifle to be used as a single-loader.

The new service gun of the United States which has been judged superior to any now in use was selected from nearly fifty competitors. It is called the Krag-Jorgensen from its inventors, two Norwegians. It weighs 8¾ pounds, its barrel is thirty inches long, rifled with four grooves, each groove three times the width of the lands and making one turn in ten inches. Its caliber is .30, its initial velocity 2000 feet per second, its range 4000 yards, and it can fire forty shots per minute. The bullet used is of lead with a nickeled steel jacket, unlubricated. It is bottle-shaped, three inches long. The bayonet to be used is twelve inches long and is knife-shaped rather than triangular. It can be used to cut brush or as an intrenching tool. The magazine is below and to the left of the receiver. Access to it is gained by a gate, hinged below, which drops open parallel to the bore. The cartridges are dropped sideways into the receiver through the open gate, either singly or in any number up to five at one time, which is the capacity of the receiver. They may be put in by hand or by a feed-case with spring attachment to force them in more rapidly. Closing the gate presses a spring on the cartridges, forcing them successively around under the receiver and finally into it from the left side. A cartridge having been thus placed in the receiver, the bolt handle is pushed forward and then downward and to the right, the bolt pushing the cartridge forward into the chamber, and a lug on the forward end of the bolt, catching in a recess in the bottom of the receiver, firmly locks the bolt and sustains it under the shock of discharge brought about by pressure on the trigger. To open the receiver the bolt handle is turned upward and to the left and then pulled directly to the rear. The first part of the movement retracts the firing-pin and unlocks the bolt. A hook on the front end of the bolt next catches the flange of the empty shell and draws it back until it meets a spring in the floor of the receiver by which it is thrown out to the ground. A cut-off is provided on the left of the receiver whereby the cartridges in the magazine may be at any time shut off and held in reserve at the will of the soldier. The special advantages of this gun are the ease and simplicity of its bolt action and the facility with which it can be at any time loaded, either singly or as a repeater. It makes no difference whether the magazine is empty or partly full, whether the breech-block is forward or back, whether the cut-off is open or closed, the gun can still be loaded with ease and always in the same manner, thus fulfilling every need of the hardened veteran or the impressionable recruit.

It is reported that Turkey has just adopted this same gun.

BACTERIOLOGY AND CHEMISTRY OF TETANUS.

By Prof. Finkler,

Of Bacteriology and Hygiene and Staff Surgeon, German Army, Bonn, Germany.

[Prof. Finkler's most excellent paper will appear in a later volume of the Transactions.]

GUNSHOT WOUNDS OF THE CHEST.

By Capt. Charles Adams,

Assistant Surgeon First Infantry, Illinois National Guard.

It is with much diffidence, Mr. President and gentlemen, that I address a body of the standing of this Association on a subject of such importance to the military surgeon as that of Gunshot Wounds of the Chest.

The importance of the viscera concerned, the difficulties attending exact diagnosis, the very considerable difference of opinion as to the treatment of certain cases, all combine, in the absence of recent and extensive experience, to make the subject one of extreme difficulty to handle. We are now entering upon a new era in military surgery consequent upon the changes now in progress in the military rifle. Any paper upon the subject dealing with the severer forms of wounds of the chest, it seems to the writer, should be suggestive rather than aphoristic.

From the time of Larrey to the present the proportion of wounds of the chest to the total number of wounded has been very nearly 1-12½ or 8 per cent. The fatality, under modern methods of treatment, has been reduced from 30 to 75 per cent under the old methods (Fischer) to 10 per cent, (Gounzier). Of course, much difference in results will obtain in collecting statistics bearing upon this point for the reason that, in some engagements, many cases come into the surgeon's hands which die quickly from hemorrhage. The more remote the dressing station from the scene of action the better statistical results will appear. Enough experience has been gained, however, to show that with aseptic or antiseptic methods rigidly applied, the mortality of to-day in chest wounds may be reckoned at one-sixth to one-quarter of that thirty years ago. The factor most potent in the ultimate result is infection. "Without infection most cases recover, while with it, most of them die, as is amply proven by the results of pre-antiseptic times" (Gehrmann).

The general classification of authors has been into: penetrating and non-penetrating wounds; under the latter we recognize:

1. Shot-blows, contusions.
2. Superficial wounds, or wounds confined to or involving only the soft parts.
3. Wounds of the bony walls.

Under penetrating wounds of the chest we place:

1. Penetrating wounds without injury of the viscera.
2. Penetrating wounds with injury of the viscera; *a*, of the lungs; *b* of the heart, pericardium or great vessels.

Two distinct conditions result from contusions of the thorax by gunshot. These conditions, in practice, should, whenever possible, be clearly separated from each other. There have been many cases observed of a condition of the thorax following contusion, which was described first by LeGros Clark under the name of Concussion of the Lungs, in 1870; by Meola, in 1879, as Commotio Thoracica. Meola distinguishes two forms, the mild and severe. In the mild form the person injured makes first a deep inspiration, after that the breathing is quick and superficial; pallor, shivering and faintness supervene, and the pulse becomes small and intermittent. The symptoms are those of lowered blood pressure and last from minutes to days. Physical examination of the chest shows no sign of internal hemorrhage; but on auscultation, feeble respiratory sounds and cardiac sounds, as if at a distance, will be heard. In the severe cases the patient falls as if struck by lightning; the heart and lungs stand still and death ensues at once. Experiments on animals by Meola, and also by Riedinger, show that these are cases of pulmonary shock, the lowering of the blood pressure being due to irritation of the intra-thoracic vagus, and the sympathetic nerve ganglia. Post mortem examination of the fatal cases shows no lesion of the organs sufficient to cause death. The differential diagnosis of commotio thoracica from contusio thoracica is to be made on the presence of symptoms of profound shock and the absence of signs of wound of the thoracic viscera. In the cases not quickly fatal, the prognosis is, as a rule, favorable. The treatment of commotio thoracica should be: rest in horizontal positions, subcutaneous administrations of ether, strychnia or camphorated oil, and cutaneous irritation.

Contusions of the thorax vary in degree from the superficial to those accompanied by the disorganization of the contained viscera. It has been frequently observed (Hamilton, Guthrie) that a soldier has received a blow upon the chest from a spent bullet—has even in

some instances been knocked down by it—and convinced from his sensations that the ball had entered the chest, and has returned to duty as soon as his fears were allayed, with no after consequences, or only those of a trivial nature. Again, the impact of a bullet on the chest without perforation of the skin, has resulted in extensive subcutaneous extravasation, abscess beneath pectoral muscles, fracture of ribs, or has been followed by a localized pleuritis or pleuro-pneumonia. The degree of injury inflicted by a ball depends upon the direct force of the shot, its weight and the amount of protection afforded the chest by the clothing, parts of the accoutrements, articles in the pockets, etc. Seydel cites a case of a soldier who was struck in the middle of the chest by a Chassepot bullet. The missile struck a leather pouch in which were three dollar pieces. The bullet was flattened on the coins, and received on its surface an impression of the inscription on one of the coins. After considerable pain and swelling at the site of injury the man recovered. Exfoliation of bone may occur as a consequence of shot contusion. Lidell says: "Any injury of bone in the nature of a bruise, however trivial it may appear at the time of infliction, may be followed by serious consequences, which it is the duty of the surgeon to anticipate or ward off if possible."

The effect upon the chest and its contents of the impact of a large missile moving slowly or striking obliquely is similar to that observed in cases in civil practice when a heavy body passes over the thorax, or the subject falls from a height or is caught between two solid bodies —*i. e.*, on account ot the elasticity of the chest walls the organs within are compressed to the point of rupture or laceration without wound of the outer coverings of the chest. These cases are largely fatal during the first twelve hours, from hemoptysis, hemothorax from ruptured lung, heart or great vessels, or later from inflammatory changes in the parts involved. The clinical picture is one of severe symptoms. Pallor, shivering, coldness of skin and extremities, respiration quickened, superficial or abdominal, great distress of patient from compression of lungs or heart by bleeding into pleural cavities or pericardium. Ashurst has collected thirty-nine cases of injury of this sort, not due to gunshot wound, however, of which only twelve recovered, and Otis has put upon record twenty-five cases, with eleven recoveries. In warfare a large number of such cases undoubtedly die on the field. The mechanism of the injury has been pointed out by Gosselin as due to the glottis being closed at the moment of reception of the blow. The greater the expansion of the lung and tightness of closure of the glottis the more probable will

be a rupture of the thoracic viscera under sudden tension. A slowly-increasing compression of the thorax may be made without causing serious injury to the viscera. Bouilly has made experiments on the cadaver which sustain the theory of Gosselin. (Riedinger.) It is markworthy that the injury to the lung is not always found at the point of impact of the missile or vulnerating body, but often distant or on the opposite side. Besides rupture of the heart or lungs from contusio thoracica, rupture of the œsophagus may occur, with escape of contents into and suppuration of the posterior mediastinum. Further, the diaphragm may be ruptured, allowing the occurrence of a diaphragmatic hernia. Riedinger records a personal observation of a man who recovered from the thoracic injury, and, dying many years afterwards, was found to have sustained a rupture of the diaphragm, through which part of the liver and some of the small intestines protruded into the thoracic cavity. This patient complained of no inconvenience from this condition during life. Cases of hernia of the lung through deficiency of the bony parietes, resulting from contusion, have been reported by Wahl, Weiss and others. LeGros Clark reports a case of hernia of the lung following contusio thoracica, the tumor appearing at point of displacement of rib from a blow on the chest. The tumor was at first of the size of two fists. Spontaneous recovery took place. Emphysema may occur from contusion. The cardiac valves may be lacerated by contusion of the chest, or the muscle be injured as in severe strain, predisposing to degenerative processes subsequently. In the milder cases of contusion of the thorax the treatment will consist of cold applications, compression by elastic bandage or bandage and wool, and later massage. In the severe cases of contusion of the thorax the conditions requiring immediate treatment are those which obtain in wound of the lung, and will be best met with rest, careful exhibition of anodynes, preferably morphia subcutaneously, and attention to hemorrhage. The treatment of the primary conditions which may accompany thoracic contusion—hemo—or pneumo thorax, or both, and emphysema—will be practically the same as that in similar conditions in penetrating wounds of the chest, and will be discussed under that head.

Superficial wounds of the chest, or those which involve only the soft parts, are mostly inflicted by grazing, grooving, seton and contour shots. These may involve the skin and subcutaneous tissue only, or may, without injury to the bony parts of the thorax, inflict severe damage upon the muscular tissues. As a famous instance of seton or contour shot we may mention the celebrated case of Dupuytren,

where the bullet, having traveled entirely around the chest, made its exit at the wound of entrance. Comparatively large missiles have been known to travel under the integument for a considerable distance without producing more than temporary disturbance of the osseous structures. The mortality from these wounds in the War of the Rebellion was only a trifle over one per cent. They are as a rule only slightly painful (Otis). These seton and contour wounds are often complicated by lodgment of foreign bodies, fragments of clothing or the wounding missile. Serious primary hemorrhage is seldom met with in the wounds under consideration, except in the infra-clavicular and axillary regions. Here we often have to deal with injury of the subclavian or axillary artery or veins; these often cause rapidly forming, diffused traumatic aneurisms and blood tumors (Conner).

Wounds of the bony walls of the chest, without penetration of its cavity, include shot injuries of the sternum, clavicle, ribs, scapula and vertebræ. Fractures of the sternum, without opening the pleura or pericardium, are of rare occurrence. Often bullets, especially of small caliber, are embedded in the bone substance; splitting and extensive shattering of the bone have been observed. Injuries of this bone, if not aseptic in course, may develop retro-sternal abscess, and of course, this bone, like all others, is not exempt from exfoliation or necrosis after injury by missiles. The clavicles are liable to fracture but rarely in an uncomplicated form, very rarely has been observed a single transverse fracture; most often there is splintering of the bone, with sharp ends and fragments. The proximity of the large vessels renders them liable to implication. Shot wounds of the ribs occur as fissured, comminuted and transverse fractures, which are exceedingly prone to be followed by exfoliation and necrosis. Bullets have buried themselves in the ribs without shattering the bone, and in some cases the ball has been firmly wedged in an intercostal space, from whence, unextracted, it has made its way subsequently by ulcerative pressure into the pleural cavity. Fractures of the scapula are most frequently complicated with wounds of the thoracic cavity. The passage of a ball transversely may be followed by great displacement of the fragments through muscular action. Fracture of the neck, producing lowering of the shoulder, may appear like dislocation of the humerus. Extensive comminution of the bone is frequently observed. With fracture of the scapula we find often free hemorrhages and frequently large extravasations beneath the bone. Gunshot wounds of the dorsal vertebræ are most often seen in combination with lesions of the pleu-

ral cavity, but may exist without penetration. A large missile may cause severe concussion of the cord without external wound. The processes and bodies of the vertebræ may be fractured with or without penetration of the canal. Injury of the cord itself will be declared by nervous symptoms which, if the cord be severed, will amount to complete paralysis. Injury of the spinal nerves near to or at their emergence from the canal will be shown by a similar condition of the area supplied by the nerve in question. Pressure upon the cord is occasionally made by fragments of bone driven inward upon it.

The treatment of non-penetrating wounds of the chest should be governed by the same rules which are applied to the treatment of wounds in general, the ideal in chest wounds being *primary, aseptic or antiseptic occlusion.* It is to be borne in mind that all interference with the wound is to be aseptic, and the risk of converting a non-penetrating into a penetrating wound of the chest should forbid any unnecessary probing. Whenever practicable, under strict antiseptic precautions foreign bodies should be removed. Where these are engaged in a superficial wound the procedure is easy, but often lodgment occurs under thick muscular layers or under the scapula, sometimes rendering discovery of lodged bodies exceedingly difficult, if not impossible. A ball has been known to carry a part of the clothing before it in the shape of a glove finger, and to be withdrawn with the clothing from the wound; so that the existence of a wound does not always imply the lodgment of a bullet. Sharp points of fractured bone, threatening puncture of the underlying pleura or pericardium, should be cut off and all splinters removed, as far as possible with safety to the patient, to prevent infection and remove sources of irritation. On account of the disastrous secondary consequences of shot injury of the spinal column especial care should be taken, within the bounds of prudence, to remove from such wounds all foreign bodies. With that end in view, if the location of the ball, bone splinters or any other foreign bodies can be definitely ascertained, the wound may be enlarged for their removal. "Under no circumstances should any extensive cutting operation be practiced in the search for a ball the location of which has not been ascertained by touch. Formal trephining has not as yet resulted favorably, but decided benefit has in some cases followed the elevation of depressed spinous processes and laminæ." (Conner.) Rest is an essential in the treatment of these cases, both for the patient and the affected part. After the wound treatment the spine should be

immobilized, the bladder and bowels receive regular attention, and the patient put upon a strict antiphlogistic regimen.

Hemorrhage must be checked by ligation of the injured vessel in the wound itself, the wound being enlarged for that purpose if needful. If this fails ligation of the vessel should be made on the cardiac side of the injury. Styptics should be mentioned only to be condemned. Compression has been successful in many instances, but should be used only when the vessel can not be reached or for lack of time for the necessary operative procedure. Wounds of the internal mammary artery may be secured *in situ* or by ligature in the second, third or fourth intercostal space, below and sometimes in the fourth space, the artery can only be reached by resection of a costal cartilage. The intercostal arteries may be ligated in the wound itself, resection of a portion of rib may be made in order to reach it, or Agnew's procedure of casting a ligature about the rib itself may be practiced. Compression by Desault's purse may be tried when time may not be taken for a more radical procedure. Regarding injury of the axillary vessels, Conner says: "The exceedingly dangerous bleedings from the axillary vessels (those from the artery being much graver than those from the vein), which, though undoubtedly they have at times been stopped by compression, yet can be safely treated only by ligation at the seat of injury rather than above it, or by ligature followed by amputation of the whole upper extremity."

The wound being cleared of foreign bodies, and hemorrhage definitely checked, should be converted as far as possible into the condition of an incised wound. Ragged edges should be pared or trimmed; in small wounds an elliptical incision may be made to remove the injured integument, the wound made aseptic, sutured in layers and dressed antiseptically. To facilitate healing of the wound (chest wall wounds are slow in healing on account of movements of respiration) and to promote the comfort of the patient, the whole thorax, or at any rate the wounded half, should be immobilized by plaster of paris bandage. Fractures after antiseptic treatment of the compounding wound, according to the foregoing suggestions, should be dressed according to established rules. It would be desirable to make the first bandages temporary until the progress of the wound can be noted, and then a permanent fracture dressing made by application of water glass or plaster of paris over the first.

Penetrating wounds of the chest without injury of the thoracic viscera are seen occasionally. The intimate contact of the pulmonary and costal pleura makes such wounds exceedingly rare. Grazing and

contour shots which strike the thorax at a tangent may run under the intercostal muscles and open the costal pleura without involving the pulmonary pleura or the lung substance. Opening of the pleura may be caused by a bone splinter carried in advance of the ball or by the ball itself. The ball sometimes remains sticking in the wound, and falls into the pleural cavity. The exact diagnosis of these injuries is attended by much difficulty. Some information is to be obtained generally from examination of the wound. Traumatopnœa, the to-and-fro passage of air through the wound, the expulsion of foamy sanguineous discharge during expiration and emphysema of the skin surrounding the wound indicate opening of the pleura.

Pneumothorax evinced by amphoric resonance, absence of vocal fremitus, expansion of the chest wall, fullness of the intercostal spaces and dyspnœa is a frequent but not constant effect of penetration of the pleural cavity. The non-appearance of pneumothorax is, however, according to Koenig, not proof that the pleura has not been opened. The wound, although penetrating, may have been closed by the alteration in position of the muscular layers through which it passes. The thicker the muscles, the more likely is this to have taken place. Pathological conditions, as pleural adhesions, may make the formation of a pneumothorax impossible. Hemothorax shown by dullness on percussion, absence of lung sounds, fullness of intercostal spaces, dyspnœa from compression and displacement of heart and lung, and the symptoms of internal hemorrhage may occur from hemorrhage into the pleural cavity from the internal mammary or intercostal artery. It has happened from a small wound of the subclavian vein. Pneumo-hemothorax may be present and recognizable by dullness on percussion of the dependant portion of the pleural cavity and increased resonance of the upper portion. Metallic tinkling and absence of respiratory sounds will be noticed. Distress in breathing will correspond to the amount of compression of the heart and lungs.

Penetrating wounds of the pericardium have been observed without wound of the heart. These give rise to pneumo or hemopericardium; so-called hernia or prolapse of the lung through the open wound is rarely seen, as the lung more often collapses.

Most penetrating wounds of the chest are complicated by wounds of the contained viscera. Frequently, when an opening has actually been made in the chest wall, diagnosis as to visceral wound is rendered obscure by many conditions as, *e. g.*, when the missile is small and has entered obliquely, or, from change of position of the patient, the parallelism of the wound through the different layers of tissues is changed,

or the ball may have entered through the thick muscles of the shoulder and dorsal region or through the scapula. The presence of two wounds, entrance and exit, does not prove the perforation of the chest, for the case may be one of seton or contour wound. Hemoptysis may occur from all grades of contusion and also in many cases where there is no direct injury of the lung. Severe shock may be present without wound of the lung, and, further, may be absent when the lung is penetrated or perforated. Free external hemorrhage or internal forming hemothorax, may come from an internal mammary or intercostal artery. Emphysema, much more frequent in stab than bullet wounds, may come from air inspired through wound of entrance; so also pneumothorax and traumatopnœa. Lumbar ecchymosis, held by Valentin and Larrey to be a trustworthy sign of hemothorax, is thus disposed of by Legouest: "This symptom is without importance, and its appearance, always late, adds nothing to the diagnosis." Pain is not always severe; frequently very slight. Cough, occasionally very harrassing, is not so frequent as might be supposed. In addition to the physical evidence obtainable by sight, touch and hearing, we must consider the aggregate of signs of wounded lung, which, as before said, are by no means constant or always present. These are shock, collapse, faintness, dyspnœa, hemoptysis, foamy expectorations, hemo or pneumothorax, traumatopnœa and emphysema. Conner says: "Early and persistent marked reduction of temperature furnishes strong presumptive evidence of visceral lesion." Injury of the heart or pericardium is rendered probable by quickly-appearing great shock and precordial oppression, with succeeding pericarditis or endocarditis (Conner). Physical examination of the chest gives us reliable information as to the existence of pneumothorax, hemothorax or pneumo-hemothorax. A knowledge of the position of the patient at the time of reception of the injury may be of service in judging the probable course of the missile. Examination of the clothing over the wound of entrance should be made to ascertain possibility of lodgment of portions of the materials in the wound. Wounds of the lung increase in gravity as they near the root. Perforation of the edge of the lung may occur without giving rise to any positive symptoms. Central injuries give rise to quickly fatal hemorrhage in many instances. Habart reports that the new rifle bullets of small caliber inflict small, smooth-walled wounds of the lung tissue, narrow and hard to trace, and prone to severe after hemorrhage. Otis doubts the occurrence of recovery after a case of perforating wound of both lungs, but cases have been reported by Fischer and Sommerbrodt where post mortem section made

years after the reception of the injury showed that both lungs had been simultaneously wounded. Wounds of the heart and great vessels are, in the majority of cases, speedily fatal from primary hemorrhage. Some cases live for some time, however, hours to days, and rarely a shot wound of the heart is followed by recovery. Thus Hamilton says: "I have in my possession the heart of a man named John Kelly containing a round musket ball which lies encysted in the apex of the right ventricule, and which was received twenty years before his death. There is conclusive evidence that during the first five years it lay near the right jugular vein, and that, having at length made its way through the coats of the vein, it dropped into the ventricle, and finally became embedded in the walls of the heart at its apex. It remained in the heart there for fifteen years, and was not then the immediate cause of his death." Fischer has collected four hundred and one cases with fifty recoveries; the diagnosis in thirty-three of the latter having been verified by post mortem section. The symptoms of heart wound are shock, precordial distress, cold sweat, pallor, small and intermittent pulse, cardiac dullness, increased in area and intensity and proof of hemopericardium. Heart sounds are diminished in intensity as likewise the cardiac impulse. Asystolic bellows murmur is the most usual abnormal murmur observed in cases of heart wound (Ashurst). These symptoms are not constant. The position of the wound directly over the organ is not proof that it is injured. The writer has seen two cases in which the heart was apparently directly in the track of the ball, but no sign existed of cardiac injury. Wounds of the pericardium are particularly dangerous through danger of compression of the heart by pneumo or hemopericardium. Rose has shown that hemopericardium causes death through paralysis when the blood in the pericardium prevents diastole by pressure.

The essential treatment in cases of this kind, after checking hemorrhage from all sources outside the thoracic cavity, removal of foreign bodies when within easy reach, as previously advised, and antiseptic cleansing of wound, is to secure primary antiseptic occlusion of the wound. Foreign bodies are not to be sought for in the lung substance. Bullets may become encysted, or, in the event of irritation arising from their presence, may be dealt with later. Prolapse of the lung should be replaced, when possible, by enlarging the wound for that purpose. It must be remembered that we may produce a pneumothorax by replacement of the prolapse. The prolapsed portion of lung having been made aseptic should be replaced under a large piece of protective, so as to prevent aspiration of air into

the pleural cavity. If reduction be impossible cover with large antiseptic compress to promote aseptic necrosis and casting off of exposed portion. Guthrie speaks of three cases doing well under simple dressing—cold water compress, and advises non-interference. Up to 1870, according to Otis, only one successful case of replacement had been reported—that of Angelo. Riedinger has collected four cases, in all of which the replacement was successful. Ligature of the prolapsus has been practiced, but was followed in one case by tetanus (Kirchoff). The tetanus was relieved by loosening the ligature. Having closed the wound our next care is for complications. Pneumothorax, unless producing dangerous compression of viscera, may be left alone, being as a rule quickly disposed of by absorption of the air. If it exert too much pressure it should be relieved by puncture, preferably aspiration.

Emphysema, unless very extensive, may be confidently expected to disappear under the compression of the dressing. If of large extent multiple punctures may be made. All penetrating chest wounds should be carefully watched for hemorrhage. Hemothorax of small, or even quite large, extent may be absorbed by the pleura, or, after some days, when occlusion of the bleeding pulmonary vessels by thrombosis has taken place, the blood may be removed by puncture, under aseptic precautions. What shall we do for cases of hemothorax threatening life by compression of heart and lungs, as well as by hemorrhage? Up to the time of the Crimean War venesection was universally practiced in chest wounds, first, to produce hemostasis, and second, to avert inflammation. During the Crimean War the practice was abandoned by many surgeons, and has had only slight support since. H. Fischer recommends it in exceptional cases of great dyspnœa and cyanosis when other means fail. The general rule of practice in hemothorax threatening death by compression now is, under aseptic methods, to puncture or incise chest, evacuate enough of the contained blood to relieve symptoms, and close puncture, letting the patient lie upon the wounded side.

Von Lesser says: "But after having learned from the results of antiseptic wound treatment that the dangers in opening large body cavities lie elsewhere than in the mere exposure to air, it will be the task of the future to conceive and try a direct hemostasis in pulmonary hemorrhages, if possible, under the protection of antiseptics, after the affected part of the thorax has been laid open." For cases of slowly increasing hemothorax the plan suggested by Rushton Parker deserves further trial. This consists in the conversion of the hemo-

thorax into a pneumo-hemothorax by the injection into the pleural cavity of air, sterilized by being forced through a carbolized solution in a Wulff's bottle. It produces compression of the bleeding lung without the loss of blood to the patient, and may be done through aspirator needle. In severe cases of hemoptysis, hemostasis has been produced by shutting off from the general circulation the blood contained in the extremities by constricting bands applied near the trunk, producing thereby syncope, after which the blood in the extremities is gradually returned to the heart by loosening the bands at intervals. This procedure might be of service in growing hemothorax. In cases where pleural adhesions fix the lung to the chest wall, if such condition could be definitely ascertained, gauze tamponnade of the lung wound might be used. Hemo-pericardium must be treated by evacuation of the pericardium by operation or enlargement of wound whenever paralysis of heart is threatened. The experiments of Block on animals lead us to hope that suture of the heart wall may yet be successfully practiced on the human subject. Suture of the pericardium itself has been successfully done. The patient suffering from a penetrating wound of the chest should be treated by absolute rest, cooling drinks should be administered, or small pieces of ice to allay thirst. The application of cold to the chest surface is not often a practical measure, as the cold will not be effective through such a dressing as should be primarily applied. This should be liberally thick. Of the drugs which have been recommended in chest wounds nothing calms the patient, eases pain, and has a better effect upon the hemorrhage than morphia given by hypodermic injection. Ergotine administered in the same way may be of service in hemorrhage. Digitalis may be needed to strengthen a heart failing from acute anemia. Alcohol in any form should be cautiously used for fear of excitement of the circulation. The diet should be liquid and sparing.

GUNSHOT WOUNDS OF THE ABDOMEN.

By Brigadier-General J. D. Griffith,

Surgeon-General of National Guard, Missouri.

Mr. President and Gentlemen: The subject assigned to me for discussion at this meeting is wounds of the abdominal viscera. Our President, Professor Senn, has by his works and writings so completely covered the ground of the injuries inflicted by the ordinary leaden bullet, and their treatment, that if no developments had taken place in the history of missiles nothing of real value could be contrib-

uted to that subject at this meeting. But since Professor Senn published his epoch-making experiments and demonstrations a vast change in character of small-arms and their ammunition has taken place. Instead of the conical leaden bullets which replaced the spherical balls of our fathers and the black gunpowder which has been used for ages, we have to face new problems. The explosive now in use is new and more powerful; the missiles are still conical, but are mantled with a hard metal. All civilized nations to-day have adopted practically the same gun and ammunition. The gun is of smaller caliber. There is increased velocity of the extra hard missile, and the wounds inflicted differ so much from those made by the now obsolete weapons that while by the tacticians new and intricate problems have to be solved, by us as new and as intricate problems have to be faced.

In this paper I propose to criticise as well as I can the observations as to the actions of these new appliances of destruction on the living body, and record some observations which I have had the honor to make. At this point I desire to express my thanks to the authorities and officers of Fort Leavenworth for their kindness in assisting me in every way possible in making these experiments which I shall present to you; also, to thank Lieut. W. S. Scott, of the First Cavalry, in particular, and Capt. L. A. LaGarde, United States surgeon in charge of the United States Army exhibit at Jackson Park, for valuable information, and Dr. J. F. Binnie, Dr. H. E. Pearse, Dr. W. T. Stark and Dr. Newton McVey, all of whom rendered me valuable assistance.

The last rebellion in our own country, and the still more recent wars of Europe, show in their records the immense mortality of men wounded by the large leaden bullet (the ball now being used by our own Army and National Guard is heavier than either the English or continental). This exceeding mortality of those wounded has naturally led our civilized world to look for a weapon more effective, yet more humane. This paradoxical condition has probably been found in our own country by the adoption of the Krag-Jorgensen rifle, caliber .30. As Lieut. C. A. Bennett, Third United States Artillery, in his most excellent paper on "Smaller Caliber Small-Arms and Ammunition," says, we have arrived at another epoch in the development of the military rifle. The small-caliber repeating rifle is rapidly taking the place of the single-loader of seven years ago. All the leading powers of Europe have taken steps toward re-armament with pieces not exceeding .31 in caliber. England, Germany, France, Austria, Italy, Russia, Denmark and Belgium have adopted the small-bore system. To produce such a rapid change of armament the small-bore

rifle must possess decided advantages over the larger-calider gun. These advantages, as claimed by Professor Hibler, are:

Lighter Ammunition.
Flatter trajectory and greater danger space.
Less deviation by the wind.
Less recoil.
Greater penetration.
Greater accuracy.

Last, and the one which particularly affects the surgeon,
Wounds, while sufficient to disable, are much more humane.

Again, Billroth, of Vienna, thinks the use of the smokeless powder will make future wars more deadly, at least in numbers of wounded, and that the subject of more transportation for wounded is the direction in which the military surgeons should study and develop. This means, of course, more than four men belonging to the first aid or stretcher men, as they are called, from each company; and when we take away ten from a company of eighty men it materially weakens the fighting capacity. Billroth thinks hospital arrangements of modern armies have not kept pace with the development of other branches, and should everywhere be at once brought to an effective strength and organization. The lightly wounded, if moved at all from the field, must be rapidly taken away by the first aid or stretcher men and moved to the shade, these first aid men moving over the field rapidly, leaving the heavily injured "tagged" for immediate surgical interference.

At this point we would call your attention to the necessity of the field hospital service having to assume entirely different positions in the field from that of the past, on account of the danger of these very long-range guns.

The striking force of these new projectiles is so great that at 600 meters it penetrates a brick wall one brick thick. The earth breastworks of thirty to forty inches will afford little or no protectection in the next war. Deployment of troops in close order will be a thing of the past, as the new bullet will go through four men, one behind the other, at 100 meters. As new arms and ammunition are so efiective, wars will probably be shorter in the future, and hence heavier demand will be made on the hopital department. The soldier of to-day, if he be expert with his firearm, will deal out forty missiles to the minute instead of the two shots of 1860. The surgeon and his staff should at least be ten if not twenty times as proficient and capable of taking care of the injured.

Gentlemen of the National Guard and Regular Army, let us not be outdone in this matter. In other words, now is the time to enter the wedge and drive it hard for the establishment of a Government medical college as well equipped as West Point in its line and supported in the same manner for the purpose of thoroughly educating men for the battlefield, from the litter-bearer and ambulance corps to the finished surgeon. With Surgeon-General Sternberg at the head of the medical department of the Regular Army, and with Nicholas Senn, the President of the Association of the National Guard, we ought to be able to accomplish this great end within a very short period. Chicago, with Fort Sheridan located very near it, and with the largest clinical capabilities in the United States, is the place, beyond a doubt, where such a school should be located. Let every member of this organization see to it that the Congressman from his district be well acquainted with such a necessity.

Captain L. A. LaGarde of the United States Army, in his most excellent and instructive report "On the Effects of the Projectile of the Small Caliber Guns," says:

"The experimental Springfield rifle is a .30-caliber gun, the projectile of which has an initial velocity of 2000 feet per second. Its projectile has a German-silver jacket filled with a core of lead. and is not cannellured or lubricated. At 2500 yards it has a velocity of 495 feet per second. The old .45-caliber gun had an initial velocity of 1300 feet per second and 425 feet at 2500 yards. This small caliber Springfield rifle has the same trajectory and ballistic property as the Krag-Jorgensen rifle."

Dr. Johann Habart, Royal and Imperial Regimental Surgeon, Austrian Army, in speaking of the same, gives this gun an initial velocity of 620 meters to the second, and on account of there being one complete turn in the rifling for every ten inches, the ball makes 2480 revolutions on its own axis in this distance. (Right here let me call your attention to the centrifugal force that must be exerted) and says: "The new projectile can penetrate with great facility all parts of the human body of small density at a distance of 5000 steps." Noting this, Bismarck made the remark that the battles of the future would be fought principally by the artillery. In speaking of the impact of the ball, Dr. LaGarge says the shock as shown by the oscillation of the limb where a resistant bone was hit was always greater (insurmountably so) with the leaden bullet of .45 caliber than that of the small-bore gun. This difference in shock was noted at all ranges, but especially so beyond the first zone, that is, 500 yards. This minimum of shock for the smaller projectile depends entirely upon its superior penetration, which is due to its smaller caliber, greater velocity and

the fact that it preserves its shape unaltered. Of course, then, the great amount of shock caused by the old leaden bullet was due to its flattening, as it came in contact with the body.

Dr. LaGarde, in speaking of the explosive effects caused by the projectile of the Springfield .45, noticed these up to 200 yards, whilst the explosive effects of the .30 calibre gun extended up to 350 yards. Bruns' experiments on the explosive effects of this bullet were made by shooting in water. He fired into a box filled with water 4 metres long, 4.5 centimeters wide, 60 centimeters high, the top of which is open and the front is closed with parchment to facilitate the entrance of the projectile, and by the use of a manometer found that the explosive effects were communicated in all directions, but principally in the line of flight. He found that if the box was closed on all sides and fired into the shock was so great that its sides flew asunder, to prevent which strong iron braces had to be used. He even noticed that the box was likely to be broken when a considerable space was left open at the top. Water, in spite of the fact that the particles are so movable one on the other, offered such resistance that the bullet hardly advanced more than one meter after penetrating the parchment. The old leaden bullet was badly mushroomed. This flattening of the bullet, he says, is due to the resistance it meets at the time of impact, as guns fired under water do not show any mutilation of the ball.

The hydraulic pressure is in direct relation to the velocity of the projectile.

The hydraulic pressure increases with the caliber of the bullet. The .45 caliber projectile produces the same hydraulic pressure at 200 yards that the .30 caliber gun does at 300 yards.

These experiments with water he used to explain the explosive effect on the tissues of the body. He says, as a matter of course, the hydraulic pressure is all the more noticeable the larger the quantity of moisture of the tissues, and most of all when such tissues are enclosed in cavities with more or less rigid walls. The best and most striking example of such cavity pressure is furnished by near shots against the skull.

In a case of the writer's, where a .38 caliber round ball (the old Colt revolver in the hands of a playmate), with its point of entrance just above the right orbit, passing straight through, with point of exit one inch to the right of the external occipital protuberance just above the superior curved line of the occipital bone, I found, on joining the two wounds with an incision 8½ inches in length, and laying open the

soft tissues covering the skull, the verticle plate of the frontal, the entire parietal of the right side, upper part of the occipital and the squamous portion of the temple bone, all shattered in pieces, the dura ruptured at the vertix and pouting. The line of the ball through the cerebral substance could easily be traced from before backwards the skull having been bursted by the explosive force of the ball in transit, and astonishing to say, the smaller fragments were as abundant and more so, at and near point of entrance as anywhere else.

As Bruns says, this great destructive action was formerly explained by the shape of the skull, and in order to show that it was due to a very great extent to hydraulic pressure he fired into empty skulls. He found the wound of entrance and exit of almost the same diameter as the ball; no fracture at the point of entrance and only a puncture with subperiostal fissures at the exit. At 1000 meters Bruns finds that the explosive effect of the .30 caliber ball on the skull, with contents, is lost, only small openings and a track the size of the missile being evident. Captain LaGarde, in speaking of the explosive effects of our new small caliber gun, says it extends up to 350 yards. He also remarks: "The term 'explosive effects' is somewhat confusing, as it is apt to convey the idea that the wound was caused by an explosive bullet. It is a term that doubtless owes its origin to the similarity in appearance of the two wounds. When a resistant bone has been hit the foyer of fracture will show great loss of substance, and the pulpification of the soft parts will not only be limited to the track of the bullet, but the utter destruction is noticed some distance in the tissues. The degree of explosive effects corresponds to the velocity of the projectile at the moment of impact and the resistance offered by the part hit." In order to test the influence of hydraulic pressure in causing explosive effects, empty powder cans were fired into at different ranges at Frankford Arsenal. The orifices of entrance and exit were found of the same size as the bullet, the cans were not deformed, no explosive effects were evident. A lot of cans were filled with wet sawdust, and at the same range nothing peculiar was found about the orifice of entrance. The orifice of exit, however, was marked by a bursting forth of the tin and loss of contents. The can had expanded as if by an internal force which had been exerted in all directions. A third lot of cans were filled with water and fired into. The results were similar to those containing wet sawdust, only more extensive. The explosive effects were equal, or almost so, for both projectiles, that is, the ·45 and .30 caliber. Such being the case, I call your attention to the fact that there must

be some other force brought to bear in the explosive effect of the small bullet besides that of hydraulic pressure, velocity and density of tissues. Habart says that he found explosive effects in all very vascular tissues and cavities of the body up to 500 meters. When we remember that this small .30 caliber ball is turning on its own axis at the rate of 2480 times per second, does not the centrifugal force exert some influence in this explosive effect? Where this ball strikes the hard wood, if its track be closely observed it certainly looks as though there were centrifugal force brought to bear, as I found at 350 yards, there was no ricochet at an angle of 10 degrees when coming in contact with hard wood. Of course, as we get farther away from the origin of force these rapid revolutions diminish, and as a result we have a more humane wound.

In summing up, Dr. LeGarde says: "All things considered, it is doubtful if there is just ground for the pessimistic view held by some, that the wars of the future will be much more deadly than ever before. The change from the smooth-bore gun and spherical bullet to the rifle and cylindro-conoidal bullet increased the number of wounded vastly and added to the severity of the wounds. The change from the leaden rifle bullet of .45 caliber to the bullet of hard exterior of .30 caliber will increase the mortality and number of wounded still, but the wound as a whole will be less grave, more humane. If we consider the latter with the improved sanitation which will surround the soldier of the future, and the surgeon's ability in the application of his primary dressings to prevent infection, I believe we may confidentially assert that the horrors of war, as depicted by the old writers, will never again be seen."

Habart divides the trajectory of this gun into four zones:

1st zone, from 0 to 500 meters; this is the zone of short-range shot; 2d zone, 500 to 1200 meters; 3d zone, 12 to 2000 meters. The 4th zone is called the zone of artilleristic effects, and extends to 4000 meters. He noticed extensive destructive lesions in all organs from shots in the first zone.

On the 17th day of June, 1893, we made the following experiments with the new gun, .30-caliber nickel-coated ball with leaden core, driven by smokeless powder; weight of ball, 220 grains; amount of powder, 37 grains; the distance from the muzzle of the gun to the target being a little over 300 yards. Right here let me speak of the inability, when at a distance from the marksman, to locate him, and were he in a clump of trees or hidden in brush he might sharpshoot all day and not be found. Again, not a particle of noise is made in the

transit of the ball, and, standing within ten feet of the target, watching it very closely, it was absolutely impossible to tell when the ball made its impact.

A number of beef intestines, some full of water, some half full and others empty, were suspended in a wet bag of chamois skin. Two layers of this, covering the intestines, were separated by half an inch, and the bag and contents fired into. Several large dogs were also provided.

Shot No. 1 struck the chamois-skin bag. The wounds of entrance and exit in the bag were the same size as the ball. (As this was the case in all shots which struck the bag, the wound in the chamois will not be alluded to hereafter.) This shot passed through the large intestine filled with water. The wound of entrance in the gut was ten centimeters long and the diameter of half the gut. The wound of exit was twelve centimeters long and a little wider than the wound of entrance.

Shot No. 2 struck a large intestine filled with water. Wound of entrance, eight centimeters; of exit, ten centimeters long.

Shot No. 3. This struck an empty small intestine, grazing it. The peritoneal and muscular tissues were cut through, but the mucous layer was not. The abrasion had a diameter of two centimeters. Around the wound the tissues were undoubtedly killed, so that gangrene would have followed in a living subject.

Shot No. 4 struck the side of an empty large intestine and passed through it, making one circular opening eight centimeters in diameter.

Shot No. 5 struck an empty small intestine, making an oval opening in the side about five centimeters long; tissues all around blackened.

Shot No. 6 struck a dog, killing him instantly. The animal never uttered a cry. Weight, at least 50 pounds. Ball entered at the right side of the neck, grazing the sixth cervical vertebræ and passing through the seventh, also the first and second dorsal; passed out of the back of the left shoulder; wound of entrance the same size as the ball; wound of exit slightly larger; both were circular. The soft tissues for about four to five centimeters on all sides of the bullet track seemed absolutely destroyed; everything was blackened along the line of transit and the tissues terribly lacerated.

Shot No. 7 struck a dog, weight 35 pounds, killing him instantly; no cry whatever; wound of entrance on the left side of the neck near the shoulder; same diameter as that of the bullet; wound of exit back of right ear and slightly larger than ball. The ball passed

ILLUSTRATIONS OF

GEN'L GRIFFITH'S ARTICLE ON GUNSHOT WOUNDS OF THE ABDOMEN.

through the first and second cervical vertebræ cutting the cord, the substance of which protruded through the wound of exit. The tissues throughout the entire track of ball were killed for a distance all around of from 4 to 5 centimeters.

Shot No. 8 struck au empty gut; the entrance wound 7 centimeters long by one-half the diameter of the gut; that of exit slightly larger.

Shot No. 9 struck another dog; wound of entrance was on the right side one inch from the medium line and just above the line of the attachment of the diaphragm to the anterior chest wall. The dog was dead before the sound of the gun could be heard. This shot opened the pleural cavity and the lung was found collapsed. It passed through the left lobe of the liver, causing a very large, stellate wound, the fissures radiating in all directions from the point of contact with the ball; passed between the cystic and hepatic ducts and wounding neither. Both, however, would have gangrened. After making an abrasion on the colon which presented all the appearance of the tissues being killed for an inch in diameter, it made its exit with a small, clean wound in the back of the dog at the right side of the vertebral column, clean cut as if by a knife.

Shot No. 10; another dog killed. The bullet passed through the abdomen, entering on the right and going out at the left, not touching the spinal column; no cry was made by the dog. Numerous wounds were made in the intestines and mesentary, and in all of them, especially those of the intestines, which were even partially filled, the wounds of entrance and exit are very much larger than the ball and the tissues killed for quite a distance around. The mesentary presented very large openings with marked discoloration.

Shot No. 11 struck a live dog at less than 100 meters, entering just back of the right short ribs about four inches from the spine, passing through the body diagonally; exit back of left shoulder; dog fell dead, although no vital parts were struck. The abdomen was opened and the intestines were found torn and lacerated as if some explosion had taken place within. One section of the gut, about twelve inches long, was severed completely, mesentary and all.

It has been utterly impossible for me to obtain ammunition for the gun, and the consequences are, that my experiments were stopped in the first zone. I shall pursue these experiments in the second and third zones on intestines and cavities of the body and give you the results at a future meeting.

In conclusion, Mr. President and gentlemen, allow me to say that our new rifle is anything but a humane gun in the first zone, the explosive effects being perfectly terrific—death being instantaneous in the dogs—even though no vital parts were struck. Again, it was noted that wherever a vessel was struck, the opening was absolutely clean cut as if by a knife—no "curling up" of the inner coat—so that hemorrhage could only be checked by stoppage of the heart beat.

GUNSHOT WOUNDS OF THE LONG BONES.

By Major George R. Fowler.

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In the present state of military science firearms of long range, small caliber and conical missile, together with great penetrating force, have largely taken the place of the .48 and .50-caliber arm with heavy projectile. Penetrating and perforating wounds of long bones will therefore be more frequently met with than formerly, when a bone was literally shattered by an ordinary bullet.

Injuries to the long bones, and particularly those of the lower extremities, must necessarily form an important part of the surgeon's experience while in active service. This is due to several causes: The injunction of the military commander to "fire low" is based upon the policy that it is better to cripple than to kill. He knows that nothing is better calculated to demoralize an opposing force than the cries and groans of its wounded, and that considerations of love and comradeship will impel the soldier to throw away his rifle to minister to the needs of his fallen brother. For every soldier killed outright a dozen men will press forward in the charge, animated by motives of vengeance; for every soldier wounded and in need of succor two or more men will be taken from the numerical strength of the command, either by detail or as volunteers, to care for him. The introduction of the machine gun, with its low sweeping range, and of the repeating rifle have still further increased the importance of this class of injuries, as compared with bayonet and sabre wounds.

The organization of this symposium shows a full appreciation of all those facts, and the realization of the importance of the subject of gunshot wounds in general.

As might naturally be expected, the greatest possible diversity will be found to exist in different cases of gunshot injuries of the long bones, as elsewhere. Differences in velocity, projectile force, angle, articles perforated before the ball reaches the body and tissues tra-

versed prior to coming in contact with the bone all have an influence in determining the character of the injury to the latter.

A ball may strike a long bone, glance off and bury itself into the surrounding structures. Under these circumstances a contusion of the bone results. Although the injury to the soft parts, together with its sequelæ, will occupy the attention of the surgeon, the fact is not to be lost sight of that certain changes may take place in the bone itself. The periosteal investment and the bone likewise suffer devitalization, and the way is opened up for infectious periostitis and ostitis. The infection may find its way into these structures, either directly from foreign substances carried in with the ball itself, or secondarily, from suppurative processes having their point of commencement in the soft parts, and subsequently extending to the bony structures. In either case the ordinary results of such infection, namely, necrosis, sufficiently extensive to imperil both life and limb, may follow.

A partially-spent ball, arrested in its progress by passing through a cushion of muscular tissue, may be flattened against the bone, striking the latter squarely, instead of glancing off obliquely, and a contusion result from this cause.

The effects of missiles in producing wounds of bones will vary with the velocity of the ball, the relation in point of size which this bears to the injured bone, and with the relation which the latter bears as regards support and resistance to breaking strain to the surrounding structures. A small conical ball from an arm which has been fired at short range, and which still retains the greater part of its velocity upon reaching the bone, will, upon striking the latter at a line at right angles or nearly so to the plane of its surface, either bury itself into the bone, pass into the medullary cavity or make its way through the bone. A lacerated wound of the bony structure, or a penetrating or perforating wound of the medullary cavity or cancellous structure will result.

A large missile, under the circumstances last mentioned, will produce a fracture if the impact is received upon the diaphysis of the bone. The fracture is usually more or less comminuted in extensive injuries, fissures extending longitudinally. The fragments become displaced, and, in addition to the functional disability resulting from extensive loss of bone, either through immediate removal at the hands of the surgeon or subsequent necrosis, dangers arising from fat embolism are to be apprehended. This is due to the large number of fat globules liberated from the medullary structure and displaced into the surrounding soft parts.

The complications most to be dreaded in gunshot injuries relate to important vessels and nerves. While hemorrhage from vessels in the torn and lacerated muscular structure may be at first profuse, the irritability of the latter, producing involuntary contractions, together with the tendency on the part of the bruised and irregularly divided walls of the vessel to favor coagulation, leads to rather prompt arrest of the bleeding. Unless some vessel other than those located in the mass of muscle is wounded the hemorrhage is surprisingly slight in gunshot wounds of the extremities. More blood is lost from the vessels of the subcutaneous connective tissue at the site of the wound of entrance and exit than from the entire wound track through muscle and bone.

The hemorrhage, however, may assume an immediate importance and be at once alarming and dangerous, owing to the injury of a large arterial or venous trunk. If the vessel is wounded directly by the ball in its passage to the bone, the hemorrhage will be less than if the vessel is perforated or punctured by a sharply-pointed splintered fragment. Or if the ball in its passage through the bone becomes divided or changed in shape, its margins becoming irregular or jagged in outline, contact with a vessel under these circumstances will result in a lateral wound of the latter, and profuse or rapidly fatal hemorrhage follows. On the other hand, complete severing of a vessel, even of considerable size, will permit of retraction of the divided ends and contraction of its tunics. The irregularly-shaped and roughened channel, with its torn and projecting portions of muscular tissue, favoring, as it does, the formation of large coagula at this point, by its mechanical effect in damming back the flow of blood, may lead to the arrest of the hemorrhage, even in the case of wounds of large and important vessels. The weakened heart's action resulting from the loss of blood, together with that following the shock, may also lead to temporary arrest of hemorrhage, the latter recurring when stimulants are administered or the patient rallies from other causes. The symptoms may now return in all their severity, or become even more alarming than at first. It not infrequently happens that this recurrence leads to rapidly fatal collapse, the pulse becoming indistinct or entirely lost at the wrist, "between two beats," as it were. The recurring gush of blood becomes the "last straw" that breaks down and overpowers the already staggering vital forces.

More or less injury to nerve structure always occurs in gunshot as in injuries from other causes. The slighter forms of injury, however, rarely give rise to symptoms other than those of pain, and even this

may be held in abeyance, owing to the contused and temporarily paralyzed nerve filaments. Those struck by a ball spent or nearly spent will suffer more pain than those who are struck by balls with a high velocity and great projectile force. Hence it not infrequently happens that one struck by a nearly-spent ball will at once be possessed by an exaggerated idea of his injuries, while a person struck by a ball which has retained its full penetrating force will scarcely realize, as far as any suggestion coming from the seat of injury is concerned, that he is injured at all. In the one case the local disturbance is out of all proportion to the extent of the injury, while the shock is almost nil; in the other case the man falls down in a faint condition, and although he suffers greatly, scarcely knowing from what, he does not appreciate the fact that he is hit, much less does he attempt to locate the seat of the injury. Therefore the velocity of the missile will govern, in a great measure, the extent and degree of the pain as well as the occurrence of shock, even when nerve branches of minor importance only are the seat of injury.

In gunshot injuries of long bones, owing to the proximity of these to large nerve trunks, the latter are more or less liable to injury, either from the direct blow of the ball, by force transmitted through the medium of a fragment of bone, or by muscular contraction forcing pointed or sharp-edged spiculæ against the nerve trunk. Injury to important nerves, when sufficiently severe, leads at once to complete and indubitable paralysis of their peripheral distribution. The importance of nerve injury, however, is not entirely due to the immediate local effects of the traumatism. In addition to these, which are of themselves sufficiently serious, injury to large nerve trunks greatly increases the surgical shock, which may become so profound as to bring about a rapidly fatal inhibition of necessary and vital functions. The velocity of the missile, if this produce the injury to the nerve, at the time it comes in contact with the latter, will also govern its effects in the production of shock. If the nerve is injured by the ball immediately after entering the extremity and before passing through the thick muscular structures and bone, the violent impact against the nerve fibers produces an impression, the immediate effect of which reaches to points at a distance more or less remote from the locality of the injury, and even to the nerve centers themselves. As a result of this, the functions of the latter become inhibited or arrested altogether and the peculiar train of symptoms comprehended under the general term "shock," develop to a most extraordinary and alarming degree.

On the other hand, if a large nerve is contused with great force or even torn asunder, if the process is a comparatively slow one, there is not the same rapid development of shock, although this may supervene later on. The ball, as it passes through the muscular structures and bone loses much of its velocity, and, coming in contact with nerve structures with diminished force, produces less disturbance of the nerve trunk at a distance, although the nerve at the point of injury may suffer considerable damage. Or, if the missile miss the nerve altogether, but drives the broken fragments against the latter, contusing and perhaps tearing it, the symptoms of shock will be much less than if a body with high velocity strikes it.

The involuntary muscular contraction which immediately follows the giving way of the bone, and which serves as such an important factor in producing displacement of the fragments, may, by driving the latter against the nerve trunk, produce more or less injury. This may vary from a slight contusion to a laceration of the latter. Or, the nerve trunk may become entangled between the two sharp-edged fragments and be completely severed.

In addition, the pressure of a large fragment upon the nerve may produce, for the time being, symptoms referable to this cause, and which are only of a transient character.

The symptoms which follow injury of the nerve will vary according to the seat and extent of the injury. There may be only a slight and momentary tingling sensation referred to the peripheral distribution; a numbness lasting for a short time and then disappearing; excessive pain due to pressure upon a fragment, which is not sufficient to interfere with its function; a paralysis due to contusion, but from which the parts recover in a short time; an immediate paralysis due to violent contusion, crushing laceration or complete division of the nerve; or there may supervene symptoms due to the subsequent occurrence of either a localized or extending neuritis.

In the diagnosis of gunshot injuries of the long bones, unless a fracture has taken place, inspection will not furnish any definite information. The wound of entrance presents no characteristic signs indicating that the ball has impinged upon or invaded the osseous structure. Under proper aseptic precautions the surgeon proceeds to determine this point. His finger is to be passed into the wound, the latter being enlarged if necessary. If the finger encounter a bared portion of the shaft of the bone laterally, the ball has struck the latter obliquely, glanced off and buried itself in the soft structures or passed completely through the limb. Or, he may encounter the round open-

ing in the bone itself which marks the point where the bullet entered the osseous structure.

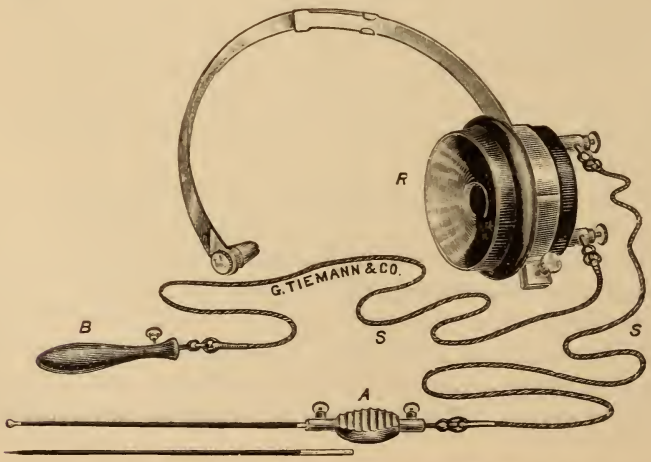
If a fracture has taken place the limb will present a condition of deformity proportionate to the extent of displacement of the fragments, and the exploring finger will determine the presence and location of these. The surgeon's next interrogatories will be directed as to whether the ball is still located in the tissues or not. He will therefore seek to ascertain if there is present a wound of exit, as well as one of entrance. Several fallacies may enter at this point. The presence of but one wound does not always determine the question affirmatively, any more than the presence of two wounds can decide it negatively. In the first instance the ball may have dropped out in transportation, or may have been dragged out by a portion of clothing which was carried in with the ball and still remained attached to the arm of his coat or the leg of his trousers while his comrades or the members of the ambulance corps were undressing him, before the arrival of the surgeon. An accurate inspection of the surroundings, the litter upon which he was transported, as well as the clothing itself should therefore be made. Failing to find the ball, attention should be directed to the possibility of the ball lying superficially located. To this end every portion of the limb is to be carefully examined which could have possibly been placed in the line of the projectile in its flight. Next, the possibility of the ball having been deviated from its course by contact with the bone, or even by dense planes of intermuscular aponeurotic structures, after its force was partially spent, should be taken into account. Careful palpation of probable, first, and then possible area should be performed, in order to be certain that the missile does not lie directly beneath the skin at some point accessible for purposes of removal, without instituting a formal and perhaps excessively dangerous operative procedure. All suspicious elevations of the skin should be carefully examined by the surgeon's fingers, and due note taken of their location, and the possibilities discussed as to their nature.

In cases in which two wounds exist, one representing the point of entry and the other that at which the ball left the limb, there still may exist a doubt as to the presence or absence of the missile, or at least a portion thereof, in the tissues. Here, again, the wisdom of examining the clothing is manifest. A ball may have been divided or split by contact with a sharp piece of bone; in its further passage a portion may leave the body by the wound of exit, while the rest still remained lodged in the tissues. The portion which escaped may sometimes be

found in the clothing, and form the basis, its divided condition being apparent, for further search.

When once the surgeon has settled in his own mind that all, or a portion of the ball is still located in the tissue, his next consideration will be to definitely locate it, and perhaps provide for its safe removal. If the ball has embedded itself in the bone the wound in the latter will be at once apparent to his touch, and perhaps the ball be found to be within easy reach. Or, he may find that the track leads down to the bone and that the ball has glanced off, producing a contusion of the bone and lodging itself in the tissues beyond. Again, if a fracture of the bone has occurred, with more or less comminution and displacement of the fragments, further search for the ball may be impeded by the presence of the latter. In case there has been a penetrating wound of the medullary cavity, or a perforating wound, or where the bone seems to be invaded by the bullet, the latter being embedded in the osseous tissue, the use of a probe will be indicated.

The instrument known as Nelaton's probe, with a tip of unglazed porcelain, has undoubtedly proven to be a very useful means for the detection of lead missiles in times past. To-day, however, we possess in the telephone probe an instrument which bids fair to rival the device of the famous French surgeon. It needs but to be more fully known in order to establish its claims to recognition as an instrument of precision. The model of Girdner will be found to be a most useful instrument. It may be improved, however, by the adaptation of the device employed by telephone central office operators to hold the receiver to the ear, in order to permit of free use of both hands. (See Fig.)



The author's telephone probe. *B*, large electrode to be moistened and placed in the patient's hand or in the mouth. *R*, receiver with head-band or holder attached. *A*, flexible probe of aluminium, insulated, except at the tip, and connected to detachable handle and cords. *S*, flexible insulated connecting cords.

The impossibility of thoroughly sterilizing the receiver by heat, which would ruin it, suggests at once the necessity of so disposing of it as to do away, as much as possible, with the handling of it. In addition, it is very inconvenient to have an assistant hold it to the ear of the operator, for this embarrasses, more or less, the movements of the latter. And, too, the surgeon should always have the use of both hands for the proper prosecution of his work. In addition to the head-band, or holder, an arrangement may be added whereby the operator can shut off, at will, extraneous sounds which enter by the other ear, by having a soft rubber plug placed upon the further extremity of the holder, which is fitted so as to close the ear when placed therein, or which may be allowed to rest in the hollow in front of the tragus when not so employed.

A fallacy which the telephone probe may lead the surgeon into, and into which it did actually lead Prof. Stephen Smith, of New York,* is, that one can never be sure when the characteristic click is heard in the receiver whether the extremity of the probe or some portion of its lateral surface is in contact with the metallic foreign body or bullet. If the lateral surface is in contact, then no correct estimate can be made of the position of the ball. The only remedy for this is to insulate the probe everywhere except at the point. This can be readily accomplished by coating the probe with a covering of rubber cement, which should be baked on. Mr. Julius Pfarre, of Tiemann & Company, has made such probes for me, and which I have employed very successfully. Where the channel to be followed is broad, and there is room for it, a small, ordinary soft rubber catheter, drawn over the probe so as to leave the point exposed, will answer the purpose admirably.

With the flexible probe of the telephone apparatus attached to one of the cords, *S*, search is made for the ball. The large electrode, *B*, shown in the accompanying figure, is either held in the moistened hand of the patient or is placed in his mouth, between the cheek and the jaw. The receiver *R* being placed in position at the operator's ear, all is in readiness for the exploration. As soon as the probe *A* makes the slightest contact with the metal in the tissues, a peculiar grating sound, very much like that which is heard in the receiver upon a telephone line when the latter passes near to an electric light wire or is "crossed" with a grounded wire of another line is heard.

Should the operator fail to locate the ball with the flexible probe he should resort to the exploring needle. This is a rigid instrument

*Philadelphia Medical News, May 6, 1893, page 485.

with a sharp point, and is to be passed in straight lines in a systematic manner within the area in which the ball or other metallic foreign body is supposed to lie.

The presence of a large amount of blood in the clothing or other surroundings of the patient will at once suggest to the surgeon that an important vessel has been injured, even though no active hemorrhage is in progress. Palpation of some large peripheral branch of the main arterial trunk of the part injured, *e. g.*, the radial at the wrist in the case of the upper, and the posterior tibial behind the internal malleolus in the case of the lower extremity, if the patient is not too weak from loss of blood and shock, will determine whether or not the former is still intact.

The question as to how such damage has been inflicted upon the nerve structures now presents itself. The ability of the patient to move his fingers or toes, as well as his response to the prick of a needle or scalpel point in the peripheral nerve distribution, will settle the point so far as the immediate effects of the injury upon the nerve are concerned. These tests giving only negative results, judgment as to the remote effects of the injury upon the nerve trunks must be withheld.

The prognosis of gunshot injury of the long bones will depend, in a great measure, upon the character and extent of the injury and its complications, in the first place, and the means at hand in active service, for the proper care of the injured from the aseptic and antiseptic standpoint, in the second place. Many a limb and many a life, which, under the old regime, would have been sacrificed under the conditions existing in modern hospitals, are saved. These conditions are not of such a complex character but they may be extended to military post hospitals, to emergency or field hospitals, and even to skirmish lines when under fire, with proper modifications.

No comparison can be made in a paper of this character between the result obtained in civil and military practice. All or nearly all of the statistics at hand relative to this class of injuries, received in military service, have been gathered in pre-aseptic times. But the tenets and tendencies of aseptic and antiseptic surgical practice, as developed during the last decade, are so plainly set out in letters of living light that he who cannot read the handwriting upon the wall must be blind indeed.

The general treatment of shock and hemorrhage need not be dwelt upon here. With the application of the Spanish windlass, an Esmarch elastic tourniquet or some other provisional method of arresting hem-

orrhage, the surgeon turns his attention to the local conditions. The incision made for exploratory purposes may be utilized, being enlarged, if necessary, for ligature or bleeding vessels, if this can be accomplished in loco, and the removal of such fragments as it may be found desirable or necessary to take away. In carrying out this part of the procedure, it should be borne in mind that every portion of periosteum which can be made at all available for purposes of repair, must be left behind. The callus derived from the broken surfaces and from the medullary cavity is insignificant compared to that furnished by the periosteum. In separating the fragments from the periosteum, although the handle of the scalpel may be utilized, the Langenbeck or other form of periosteal elevator will be found useful and assist in rapid work.

If the bleeding point cannot be identified after getting rid of the smaller fragments, and the hemorrhage is of a character to awaken suspicion that a large vein has been wounded, both the trunk of the artery and vein in the case of the femoral and axillary may be ligated in continuity. If the veins accompanying the profunda, poplitial or posterior tibial, or those of the brachial, radial or ulna, are injured so as to require ligature, the accompanying artery need not be occluded unless it is likewise found to be injured. For the extraction of the ball Brun's sound and fenestrated curette, or a Volkmann's sharp spoon will be found useful. If it be identified in a position where one of these scoop-shaped instruments cannot reach it, the so-called American bullet forceps (Tiemann's) may be employed. It may sometimes be reached with greater facility through a counter opening, this latter being afterwards utilized for purposes of drainage. The latter course should always be followed in cases of perforating shot injury, the ball being buried in the tissues upon the further side of the bone. Upon no account should the attempt be made to remove it by chiseling away portions of the bone, which, save for the opening made through it by the bullet, is uninjured.

Where the ball is lodged in the bony structure itself, and positively identified in that location, the soft parts are to be incised for a sufficient distance, an incision made in the periosteum in the direction of the long axis of the bone, which shall include the opening made by the missile and a sufficient amount of bone chiseled away to free the bullet from its environment. It may then be lifted out with a Brun's curette or other scoop-shaped instrument, or the chisel may be driven beneath it, this being then used as a lever to pry it out.

Care should be taken to remove all portions of clothing or other foreign bodies from the wound in general, but especial care should be exercised in this regard in the case of bullets imbedded in the bone itself. Under other circumstances these will be brought in contact with the examining finger at some time during the manipulation. Their removal then follows. Or, if not thus identified, they will come to light, in all probability, some time before the final healing of the wound. But if foreign bodies, other than the ball itself, are driven into the bony structure, they will become imprisoned and remain for years, giving rise to suppurative processes and become a constant menace to the patient. The following case is illustrative of this:

Col. Ira A., while serving as Captain of Company I, Tenth Regiment, Pennsylvania Reserve Volunteer Corps, at the second battle of Bull Run, August 31st, 1862, received a gunshot injury in the left ulna. He was conveyed to the Seminary Hospital at Georgetown, D. C., where, one week afterward, an ordinary minie ball was found to be imbedded in the bone, and was easily pried out by the surgeon in charge of the hospital. The Colonel did not take an anæsthetic, saw the operation, claimed the bullet and carried it about in his pocket for twenty-nine years. The wound never healed, but continued to discharge through a small sinus. The arm was probed many times by different surgeons, the Colonel always assuring the latter that they need not expect to find the bullet in the arm, for he had seen it removed, had immediately obtained possession of it, and it had never left his possession since. In June, 1891, Dr. J. G. Atkinson, of Brooklyn, referred him to me. Upon inspection the ulna was found to be somewhat thickened at the point of injury. A small sinus was present upon the anterior surface at the part above indicated, which easily admitted a probe. This was found to enter the ulna and to pass about half way through the bone. Nothing further could be identified by this means, so resort was had to the telephone probe. No response was obtained at first; the probe was rotated rapidly in the fingers, in a boring fashion, in order to penetrate more deeply into the bone cavity, when, to my surprise, a distinct "click" was heard in the telephone. Nothing but metal would give such a reaction. The probe was moved slightly from side to side, when the peculiar harsh, grating sound was heard by myself, and the Colonel as well when I held the telephone receiver to his ear. To my unqualified assertion that there was metal in the bottom of the bone cavity, and a piece of considerable size at that, he replied by drawing the ball from his

pocket and exhibiting it to me. None of it was missing. Careful inquiry, taking into account the possibilities of metal buttons, sword hilt, and all things which could possibly have been in range when the bullet struck the arm, failed to throw any light on the subject. I therefore sent him into my service at the Methodist Episcopal Hospital, and the next morning cut down upon the ulna, chiseled away some bone from around the margin of the opening, and came down upon a dark-looking object in the bottom of the cavity. It felt and looked like cloth. The foreign body was carefully lifted out, and upon being washed proved to be a piece of a cloth-covered tin canteen. It was the exact size of the diameter of the minie ball which the Colonel had carried in his pocket for so many years. It had been punched out of some soldier's canteen by the Minnie ball on its way to the Colonel's arm, and, still clinging to the bullet, in spite of the passage of the latter through clothing, skin and muscle, it had been driven through the cortical lamella of the ulna ahead of the ball and into the substance of the shaft of the bone. When the bullet was pried out of the bone upon the battle-field they parted company, to be reunited after many years, and through the aid of an instrument the remotest suggestion of which did not exist in the human mind at the time of the reception of the injury.

The bone cavity was thoroughly cleaned out by the aid of Volkmann's sharp spoon, well irrigated and lightly packed with heat-stirilized oxide of zinc gauze. The case made an excellently rapid recovery. The arm is now as useful as its fellow, and the Colonel carries two souvenirs of the "late unpleasantness" in his pocket instead of one.

In case of injury to an important nerve, if this can be identified in the wound, measures may be adopted to restore its function. If an extensively bruised or lacerated nerve trunk be found, the indications are to resect the injured portion and reunite the ends, if possible. A portion of the central end may be isolated, split, and a flap formed, which, attached by a pedicle, is turned down and sutured to the peripheral end. If, as in the case of the brachial plexus, an adjoining nerve trunk can be isolated, a flap may be formed from this by splitting, and attached to the peripheral stump of the injured nerve in such a manner that the nerve fibers will follow their normal course. A nerve divided by being caught between two sharp fragments may be at once reunited.

The indications for amputation are the same as obtain in compound comminuted and complicated fractures generally, and need not

be discussed at length here. A limb which has suffered such extensive injury as to be practically useless, even though the patient is willing to run the risks of prolonged confinement to bed and suppuration, should be removed. More particularly is this true if, as at the present time, the military surgeon is handicapped by the want of proper antiseptic dressing materials and appliances. What wonder that a great temptation is constantly present to amputate in military life, where, in civil surgical practice, the limb could almost certainly be saved, when one takes into account the fact that the general operating case furnished even by the General Government contains, as hemostatic appliances, a Petit's tourniquet and two pairs of bulldog forceps! Fine needles for nerve suturing are absent; resection instruments, save those of the crudest pattern, are unknown; but the amputation knife is always present, and, with its keen edge, lies side by side with the broad-saw with its cruel teeth, holding out a constant invitation to the surgeon, who knows full well unless he uses them that the road of the unfortunate patient to recovery leads through the dank swamps of sepsis or the quicksands of prolonged suppuration. And all this because the Government, both General and State, cares more for an accurate allignment on dress parade, and a spotless gun-barrel and equipments, than for the maimed and unnecessarily mutilated cripples, or the lives brought into jeopardy for the want of a few paltry dollars expended in a proper professional equipment for its medical department.

A recess was taken until 10 a. m. to-morrow.

E. Chouellor,

Secretary.

THIRD DAY—MORNING SESSION.

The session was resumed at 10 A. M. in the United States Government Building, Jackson Park, Chicago, Ills.

Col. Nelson H. Henry, First Vice-President in the chair.

On motion of President Nicholas Senn:

Resolved, That a Committee on Nominations be appointed by the Chair, being one representative present from each State and Territory, one from Army, Navy and Marine Hospital Service.

Adopted.

The Chair announced the Members of Committee on Nominations, as follows:

COMMITTEE ON NOMINATION.

Brig.-Gen'l Thos. Kittredge .....Salem, Mass.
Lt.-Col. Charles Hayes.....Providence, R. I.
Capt. Arthur R. Jarrett.....Brooklyn, N. Y.
Maj. J. Wilks O'Neill.....Philadelphia, Pa.
Maj. Chas. F. W. Myers.....Paterson, N. J.
Maj. Lawrence C. Carr.....Cincinnati, Ohio.
Maj. Chas. Moore Robertson.....Davenport, Iowa.
Maj. Charles C. Carter.....Rock Island, Ills.
Lt.-Col. Chas. M. Woodward..... Tecumseh, Mich.
Maj. H. L. McKinstry.....Red Wing, Minn.
Capt. Horace E. Mann.....Marinette, Wis.
Col. R. Emmett Giffen.....Lincoln, Neb.
Maj. M. C. Barkwell..... .....Cheyenne, Wyo.
Lt. A. H. Ohmann-Dumesnil.....St. Louis, Mo.
Maj. W. F. de Niedman .....Pittsburg, Kansas.
Maj. A. C. Girard, U. S. A.....Ft. Sheridan, Ills.
Capt. Daniel N. Bertolette, U. S. N.....Chicago, Ills.
Capt. C. P. Wertenbaker, U. S. M. H. S.....Chicago, Ills.

The Committee on Badge and Seal submitted the following report:

Mr. President and Gentlemen of the Association: The action of the Association on August 9th, changing the name to that of the "Association of Military Surgeons," thereby enlarging its

scope, taking into active membership medical officers of the Regular Army, Navy and Marine Hospital Service, a revision of the Official Badge and Seal became necessary. Accordingly a new committee was appointed by your President for the purpose of taking the matter into consideration and report the changes made to the Association in Congress assembled. This committee consisted of Col. B. J. D. Irwin, United States Army, Medical Director Department of Missouri; Major H. E. Bradley, of Wisconsin, with myself as Chairman. After due consideration of several designs your committee report as follows: In order to make the Officers' Badge as general as possible, the shoulder strap and triangle are eliminated entirely, and there has been substituted therefor as follows: A hanger is to be placed at the top of the cross, through which a ribbon of the following description is to be passed or attached. The ribbon is to be $1\frac{5}{8}$ inches long and $1\frac{3}{8}$ inches wide, folded on itself when attached to the badge, and having a wide white stripe bordered on either side by a strip of red, the combined width of the red borders to be equal to the width of the white stripe. When properly folded an ordinary dress hook is placed at one point of the folded ribbon, and an "eye" at the other. The Badge or Red Cross is to be suspended from the point of the ribbon in the same position as now suspended by means of a hanger, similar to the one used by the Loyal Legion. When it is desired to attach it to the coat, one end of the ribbon is simply passed through a silk cord staple, that can be left permanently attached to the left breast of the coat, on a line equal to the top of the second upper button. The two ends are now brought together at the bottom and the hook passed through the eye, and the attachment is complete. It is believed this will be the most simple, and at the same time the most generally satisfactory badge that could be adopted. The cost of this change will be slight—only a few cents, which no doubt the present makers will arrange for the value of the gold in the discarded shoulder-strap and triangle. Enough ribbon can be had for thirty-five cents to last for ten years. The ribbon recommended to be adopted to be of very heavy gros-grained watered silk, and the colors bright and clear.

All of which is respectfully submitted.

Lieut.-Col. C. M. Woodward, M. S. T.
Col. B. J. D. Irwin, U. S. A.
Major H. E. Bradley, W. N. G.

The Committee have to thank Lieut. J. J. Kauffman, of this Association, for drafting the design which we herewith submit. Also

much credit is due Major C. F. W. Myers, of New Jersey, for valuable suggestions and for his securing the manufacture of the ribbon for the official badge of such excellent quality at so reasonable a price.

Respectfully submitted,

C. M. WOODWARD, Chairman Com.

Report accepted.

On motion of Maj. Girard:

Resolved, That of the two designs submitted by the Committee the second one be selected as the official badge of the Association.

Adopted.

The Committee on Badge and Seal respectfully submitted, through the Chairman, the design for seal which had received the approval of the entire committee.

C. M. WOODWARD,
B. J. D. IRWIN,
H. E. BRADLEY.
Committee.

Adopted.

The Committee on Badge and Seal respectfully recommend that the sample of badge ribbon furnished by the William Barr Dry Goods Co., of St. Louis, should be accepted by the Association as the official ribbon. The Secretary should be authorized to make arrangements for the purchase of such amounts as may be needed for badges and to supply all members. All badges and ribbon required by members should invariably be ordered through the Secretary of the Association.

C. M. WOOWARD,
B. J. D. IRWIN,
H. E. BRADLEY.
Committee.

Adopted.

LITERARY COMMITTEE.

On motion of Lieut. Clark, the following resolution was recommended for certain work to be accomplished through the appointment of a Literary Committee, namely:

WHEREAS, The permanency and success of our Association seems positively assured, and

WHEREAS, It is desirable that its work should be progressive, educational and systematic in all matters pertaining to Military Surgery; therefore

Resolved, That the President appoint a Literary Committee of five, consisting of two members of the National Guard and one each from the Army, Navy and Marine Service, and of which committee the President shall be the chairman, ex-Officio. It shall be the duty of this committee to outline the work for the annual meeting in advance making the necesssary arrangements for the reading of papers and all literary work coming before the Association.

Adopted.

The committee on Necrology submitted a reprot through the chairman, Maj. F. W. Byers, Wisconsin National Guard, as follows:

IN MEMORIAM.

Surgeon General J. E. Halbert, Mound Landing, Miss., active member of this Association, died in the City of New Orleans, August 27th, 1892. He was born in Green County, Ala., Dec. 2nd, 1850, and when quite young his family moved to Scott County, Miss.; and he received such educational advantages as the country schools afforded. Having a preference for the medical profession, he entered Jefferson Medical College at 21 years of age, and graduated two years later from Jefferson at Philadelphia, with honors.

Dr. Halbert then practiced medicine for a year at Forest, Miss., then moved to Washington County, where he lived for twelve years, distinguishing himself as a valuable citizen as well as a prominent physician and surgeon. He then located in Bolivar County and was elected a member of the Lower House of the State Legislature for the year 1888-9, reflecting honor on his constituents.

He was then appointed Surgeon-General of the State of Mississippi, which position he held at the time of his death.

General Halbert was repeatedly elected president of the State Medical Association, served that organization with marked ability, and in his death this National Association loses one of its most distinguished members.

DEATH OF CAPTAIN H. E. LEACH, ASSISTANT-SURGEON, DISTRICT OF COLUMBIA, NATIONAL GUARD.

A meeting of the medical officers of the District of Columbia, National Guard, was held at Brigade Headquarters May 10, 1893, to take some action upon the death of their late comrade, Dr. H. E. Leach. In calling the meeting to order Surgeon-General Geo. Henderson, said:

GENTLEMEN—This is the first time in the history of the National Guard of the District of Columbia that the medical officers have been called together to mourn the death of a member of their official family. Hamilton E. Leach, Surgeon of the First Regiment, died yesterday, May 9th, at his residence in this city. The end came about three o'clock in the morning, just as the dawn of day was breaking, surrounded by his devoted, faithful son and friends, the soul of our lovable comrade passed through the lines and made its entry into that unknown service of our Great Creator and Commander. I need not say to you, gentlemen, that the deceased was a man of unusual attainments. When we measure his capabilities by his very limited opportunities in his early life, we recognize that his accomplishments were marvelous. Whether as a soldier or a physician, as father or friend, he had rounded out a life before its dissolution, and leaves behind a record of professional eminence which his posterity can well be proud of. As a National Guard man there was no duty too severe or effort too great for Surgeon Leach, when the interests of the Guard required his service. He was my friend and adviser; affectionate, sincere in my every interest. I loved him for his generous manhood, and with the warmest love of my heart I can say to-night, peace to his ashes.

The following resolutions were adopted:

WHEREAS, It has pleased the Almighty in His infinite wisdom to remove from our midst our esteemed comrade, Capt. Hamilton E. Leach, Surgeon First Regiment District of Columbia, National Guard,

Resolved, That in the death of Surgeon Leach the National Guard of the District of Columbia has lost one who, by his devotion to its interests and untiring services, has contributed greatly to its efficiency and usefulness, and that its Medical Department has been deprived of a member whose judicious counsels, honesty of purpose and amiability of disposition had endeared him to his comrades.

Resolved, That we tender our warmest sympathy to the bereaved family in their affliction.

GEORGE HENDERSON,
Major and Surgeon-General D. C. N. G.

HONORARY MEMBER, LIEUTENANT-COLONEL ELY M'CLELLAN, DEPUTY SURGEON-GENERAL, UNITED STATES ARMY.

Lieutenant-Colonel Ely McClellan was born in Philadelphia, Pennsylvania, August 3, 1834. Appointed Assistant Surgeon United States Army August 5, 1861; promoted Captain July 28, 1866; Major and Surgeon June 26, 1876; Deputy Surgeon-General (with rank of Lieutenant-Colonel) July 1, 1892. Received the brevets of Captain and Major March 13, 1865, "for faithful and meritorious service during the war." Service: In the field with Army of the Potomac to August, 1862, in charge of general hospitals at headquarters and at Fortress Monroe, Virginia, to July, 1865; Post Surgeon at various stations from that time until April, 1874; on special duty "to investigate and report upon causes of cholera epidemic of 1873 in the United States;" Post Surgeon at various stations from 1876 to 1879: Attending Surgeon, Headquarters Military Division of the Missouri, Chicago, Illinois, November, 1889, until date of death, May 8, 1893.

PROF. WM. A. ROTH, HONORARY.

Your committee has learned that Surgeon-General Wm. A. Roth, of Saxony, died since our last meeting, and a courteous communication was sent to the proper authorities for such information as would enable us to make a fitting report, but no response was elicited.

F. W. Byers,
Geo. Halley,
M. C. Barkwell,
Committee.

Accepted.

Col. Senn, being in possession of a communication from Col. Greenleaf, Honorary President of the Association, who was now abroad, having been detailed as delegate to the International Medical Congress at Rome, Italy, asked permission to have the letter read and published, which met with the hearty acquiescence from all members present.

SHANKLIN, ISLE OF WIGHT, ENGLAND,
July 21st, 1893.

MY DEAR GENERAL SENN: I regret very much my inability to be with you at this important meeting of our Association. The work already done has been successful in its object, and now it seems to me the time has arrived for us to step outside the mere routine of a professional society and to inaugurate work that shall demonstrate the intention as well as the capacity of our members for advanced and, therefore, original thought.

The principal question that is now before medico-military men relates to the disposition of the wounded from the battles of the future.

The modern firearm combines such qualities (in itself) of efficiency that its work will be very quickly done, and the number of resulting wounds will largely exceed those dealt by any previously-contrived weapon. The storm of bullets that may be rained from it, the vast distances they are carried, the uncertainty as to the source of attack in the absence of smoke, present an aggregation of actors the result of which is difficult to appreciate unless one has witnessed the effect of a fire from this weapon on the peaceful target field, and examined specimens showing the result of impact upon the tissue and bones by the small bullet.

To see a large ten-foot target suddenly riddled with bullets that have been fired by unseen persons without noise and without the ordinary accompaniment of powder smoke—in fact, that have been apparently rained from the clouds—is an object that carries with it a very significant moral; and one instinctively asks the question, "How can any human beings live a moment in the face of such a fire?"

Many distinguished foreign medico-military men assert that it is useless to think of any means for the removal of wounded from the field during the progress of an action; that they must lie where they fall, and that our mission can begin only after the battle is over; that no medical officer, stretcher bearer or animal can pass alive through this leaden shower to give succor to fallen combatants. I can not be-

lieve this. It was said at the commencement of our civil war that we could not care for all of the wounded that the ordinary bullets would furnish, and yet we did; but we did it only after passing through a dismal period of painful experiences.

I believe that the intelligences, the inventive geniuses, the natural administrative talent of the American medical officer is equal to the task of solving this problem, and I am satisfied that no more important one can come before this association for its action.

"By what method shall our wounded be removed from the field during an action?" is the question which the encampment period in the several States afford an exceptionally favorite opportunity to study, both by drills and by new means of transportation, together with the all-important business habit of administration. I trust that in the interest of humanity, as well as of science, earnest work in this direction may be entered upon.

With the active co-operation of the General Government I think an international congress of military medical men may be brough about. I know that the War Department has been very cordial in its support of our Association, and I am sure it will continue its interest. In such a congress this and many kindred topics may be discussed with benefit to all mankind, and I hope the powerful influence of the Association may be wielded to that end.

Wishing you and your colleagues, my very good friends, an en joyable and profitable session, I am, dear General,

Your sincere friend,

CHAS. R. GREENLEAF,

Honorary President of the Association.

On motion of Lieut. Clark:

Resolved, That the Committee on Legislation formulate a bill for the organization of a Medical and Hospital Corps, and forward it to some member of this Association in each State, or, in the event of there not being a member of this Association in any State, to the Surgeon-General of that State, with the request that such bill be brought before the Military Committee of their respective legislatures and the passage urged.

Adopted.

On motion of Colonel Senn :

Resolved, That a vote of thanks of this Association be tendered to Mr. A. C. Stewart, Chairman of the Citizens' Committee, and Mr. W. M. Tamblyn, Chairman of the Committee on Finance, and through them to the citizens of St. Louis, who contributed so liberally to the success of the annual meeting of 1892, and that a copy of this resolution be published in the papers of St. Louis.

Adopted unanimously.

On motion of Capt. Jarrett :

Resolved, That all members who have paid their annual dues ($2.00) for 1893 be requested to pay into the Treasury an additional $3.00 to meet the requirements of the new Constitution and By-laws.

Adopted.

On motion of Col. Senn : To amend certain section of the report of the Committee on Military Journal, to read, the said Journal to be published "monthly" instead of "bi-monthly."

Adopted.

On motion of Major Briggs :

Resolved, That the Secretary notify all Honorary Members of the changes made in the Constitution and By-laws affecting membership and ascertaining their wishes in reference to being placed on the active or honorary list.

Adopted.

THE SELECTION AND PHYSICAL EXAMINATION OF THE RECRUIT.

By Charles B. Ewing.

Captain and Assistant Surgeon United States Army.

All men offering for military service are included in the general term, "Recruit." By "Recruiting" is meant "the operation by which men who compose an army are raised."

Definite rules and regulations for the selection of the soldier in our service were not formulated till 1840, when Assistant Surgeon Thomas Henderson published his "Hints on the Medical Examination of Recruits for the Army, Etc." This continued to be the authoritative work

till 1856, when it was republished with additional matter by Assistant Surgeon R. H. Coolidge. In '58 Surgeon Charles S. Tripler published his first volume in which he took the "Aide Memoire de l'Officier de Sante" for the French army as the basis of his work on "Recruiting and Inspection of Recruits." Though this was republished in '66, the death of the author prevented the completion of the second part. In '63, Assistant Surgeon Bartholow compiled a manual founded upon statistics issued by the Provost-Marshal General's Bureau. This work, though printed thirty years ago, contains much valuable information and is well worth perusal by all examining surgeons. The books of Assistant Surgeons Tripler and Bartholow were the official guides till '84, when Colonel Greenleaf, Deputy Surgeon-General, wrote an Epitome of Tripler's Manual, which underwent revision by the same author in '90 and '93, much new information, with some modifications of the old, appearing.

Recruiting in our service is conducted by the Adjutant-General, under the direction of the Secretary of War. It is both general and special. General when performed by officers selected and detached for such duty in the various cities where rendezvous are established. Special where confined to the department, regiment or particular military organization. Field officers are detailed to superintend the service and command the depots, which are three in number, two for infantry and artillery, and one for cavalry. I find upon perusal of the regulations of '39 that the general organization of the recruiting service of to-day does not differ materially from that of the former period.

After the recruit has submitted two recommendations as to character, which have been verified by the recruiting officer, he is examined. If found fit he is sworn in as soon as practicable, within six days after his examination, uniformed, and sent to the depot of the arm of the service which he is to enter, when, after remaining three months, he joins his regiment.

The physical examination of the recruit is conducted by the medical officer in the presence of the recruiting officer. This duty falls upon the recruiting officer when there is no medical officer present; in which case the medical inspection is made, within two days after the arrival at the depot or post, by the surgeon in charge.

Paragraph 925, A. R., says that "the physical examination of recruits will be conducted in accordance with Greenleaf's Epitome of Tripler's Manual for the Examination of Recruits." Colonel Greenleaf's Manual, having passed through three revisions, is a most excellent one. His task has been particularly difficult because it governs

the examining surgeon and likewise the recruiting officer, in the absence of a medical officer. The result is that when recruits are passed as fit at the rendezvous, then found disqualified at the depot by a Board of Inspectors convened in such cases, it becomes very unpleasant for both concerned, and particularly the medical officer, upon whom the onus usually falls. While the Boards of Inspectors at depots closely scrutinize the acts of the recruiting officer, he escapes much criticism by reason of his not being a medical man that falls to the lot of the examining surgeon. The surgeon, therefore, has a dual role, the first being to obtain the very best men and pass only those who are fit, and the second to please the recruiting officer, who usually wants a larger number enlisted. As it resolves itself into a question of quantity at the expense of quality, the experienced examiner will decide in favor of the smaller number, physically fit.

I shall consider briefly our regulations governing the selection of the soldier (recruiting) and point out according to my experience where I think they should be modified, following with some suggestions looking to an improvement in our present methods.

VISION.

Particular attention should be given by the examining surgeon to this part of his duty. A large number of rejections at the present time are due to defective vision, though no special care is taken to determine its character except in special cases. It is interesting to note the developmental phases of this branch of our work. The only one of these mentioned by Tripler in his edition of '58 is Myopia, which he says "is an objection to a recruit," and repeats this in the edition of '66. No mention is made of Hypermetropia or Astigmatism. Presbyopia is spoken of in both editions but is not disqualifying "unless decided."

The above was changed in G. O. 82, A. G. O., Washington, D. C., August 13th, 1879, when very important and comprehensive instructions were given in lieu of the paragraphs I have quoted in Tripler. Accompanying the above was a pamphlet containing a very clear and complete description of the optical appliances enumerated in the Order. This taken altogether was the most important regulation ever issued to the medical department of the army on vision, being both practical and sensible.

None of the anomalies in the refraction of the eye were disqualifying unless accompanied by disease which impaired vision to such a degree as to prevent the counting of the test spots. These test spots

were "black" and circular, four-tenths of an inch in diameter, placed on cards, and were to be counted at twenty feet. This being equal to seeing, at 600 yards distance, a black center or bull's eye three feet in diameter, on a white ground.

Besides the pack of test cards the following were furnished: A simple optometer with spectacle-glasses and test types, and a set of test wools for detection of color blindness.

The regulation just mentioned lasted eight years when changed by circular dated Surgeon-General's Office, Washington, June 7th, 1887. This did away with the test cards, types and circular spots, substituting the Snellen types of twenty feet, and modified materially the whole question of vision in the recruit.

Myopia and Astigmatism are absolutely disqualifying and Hypermetropia, "except when moderate and free from disease."

Amblyopia, Amaurosis (dim vision), and Presbyopia are not thought worth mentioning.

We quote the circular, which is as follows:

"This examination requires the greatest care and patience on the part of the recruiting officer; it is made with cards bearing the twenty feet test-types and test-characters.

"To use the cards measure off a distance of twenty feet in a straight line; place the applicant with his back to the light at one end of the line, while the examiner stands at the other and holds the card exhibiting the test-types or characters in full view of the applicant and so that a good light falls on the card. Each eye should be examined separately, one being covered with a card (not with the hand) by an assistant, who, standing behind the applicant, directs him to read the types on the card held by the examiner. If he can not read, the card bearing the characters is presented to him, which he is directed to describe. The types should be read first from left to right and then from right to left; the characters should be described as to the number of arms seen on each and the direction in which they are pointed, whether upward or downward, to the right or left. If the applicant should be unable to read the test-types or describe the test-characters correctly with either eye, he must be rejected."

It is only necessary to establish simply the defect according to this.

The inference drawn that *every* eye is perfectly emmetropic, to say the least, is fallacious. It does not state how the refractive defects—Myopia, Hypermetropia and Astigmatism—are to be determined by using simply the Snellen 20-feet type and characters. The optometer and prisoptometer are not mentioned.

The army which approaches our own the closest in its method of recruiting is the English, who have only to do with voluntary enlistments. The cost of putting a recruit into the army, due to their residence in all parts of the world, is greater than that of any other

country. Here vision is tested with the much-abused "test dots" or miniature bull's eyes, Snellen types, the ophthalmoscope and optometer. The quality of eye sight is determined by Snellen's optotypes; if, however, these can only be read short of the normal distance some defect exists, and the ophthalmoscope and optometric apparatus are brought into use; particularly where the recruit is unable to read are the test dots substituted for Snellen's.

The English regulation is to the effect that Myopia, Hypermetropia and Astigmatism are only disqualifying when accompanied with vision inferior to one-fourth Snellen. This is qualified by Longmore in the paragraph headed "Quality of Vision for a Marksman at Full Rifle Range," where he says "vision in the right or aiming eye should be normal, and this can only exist when the eye is emmetropic, or as nearly so as not to exceed 0. 5 D, or one-eightieth inch of Ametropia and when the accommodation is normal; at the same time the left or eye not employed in taking aim ought not to possess less than three-fourths of the normal standard of visual acuteness."

I have carefully scrutinized the regulations governing vision as it relates to recruiting in foreign armies, but as "conscription" is in force in the majority of them defective vision does not exempt from military service, for if found unfit in one branch the recruit is utilized in another, so that only very extreme errors of refraction act as a bar.

From my experience as an examining officer I am of the opinion that the test cards and characters supplied are entirely inadequate to the proper determination of vision and that many applicants are rejected who would otherwise be accepted.

To obviate this I think the regulations governing vision should be modified. It is quite apparent that the dots are better objects with which to test vision, especially where the applicant can not read, than rectangular objects, as the question at issue is after all whether or not the recruit can become a marksman. Therefore I suggest:

First. That our nomenclature as it relates to vision be revised.

Second. That other diseases which are disqualifying, besides those of refraction, be added to our present list.

Third. That the test dots or miniature bull's eyes be used, but that they be changed to conform with the elliptical bull's eye of the target now in use in the army, and that as the present bull's eye of the 600-yard target is 18x24 inches in the vertical and transverse diameters, the test dot should conform to this, to be seen at 4.5 m. or 15 feet; both would subtend the same visual angle. The eye is supposed to occupy the apex of a triangle, of which the diameter of a

circle seen at any given distance forms the base; then if the distance of the circle be increased or diminished, its diameter must increase or diminish in the same ratio, if the angle at the apex of the triangle is to remain unchanged. In similar triangles the bases are to each other as the altitudes. Therefore the diameter of a circle which at 4.5 m. or 15 feet distance shall be equivalent to a circle 24 inches (vertical diameter of bull's eye) in diameter at 600 yards (1800 feet) is found by the following proportions:

1800 feet : 15 feet : : 24 inches : 1-5th of an inch.

1800 feet : 15 feet : : 18 inches : 3-20ths of an inch.

Hence the size of the ellipse seen at 15 feet would be 1-5th x 3-20ths of an inch in diameter.

If we desire 20 feet as the distance at which the elliptical dots should be seen, then the following proportions would obtain:

1800 feet : 20 feet : : 24 inches : 4-15ths of an inch.

1800 feet : 20 feet : : 18 inches : 1-5th of an inch.

Thus at 20 feet the size of the ellipse would be 4-15ths x 1-5th of an inch in diameter.

A greater number of these dots should be placed upon one large card instead of upon numerous small ones, as heretofore. Thus the test would be more exact and the applicant would be unable to obtain knowledge of groups of dots as he could upon the small cards formerly in use.

Fourth. That where defect is discovered, its quality be determined, also that the prisoptometer be furnished all recruiting rendezvous so that recruiting officers, in the absence of the examining surgeon might be able to find quality of refractive error of vision. This instrument is very simple in construction and recruiting officers should have little difficulty in using it. Of course this would only apply to determination of simple and not compound refractive errors.

Fifth. That the present degrees of disqualification, especially as they relate to anomalies of refraction, be modified as follows:

a Myopia.—When the elliptical test dots can not be counted at 4.5 m., and where myopia is found to be greater than 1-20th in right eye and less than 3-4ths vision in left.

b. Hypermetropia.—Where the test dots can not be counted at 4.5 m. by right eye and less than 3-4ths vision in the left. The disabling effects of hypermetropia are more or less felt in both far and near vision and increase with age at certain ranges.

c. Astigmatism.—Where myopic or hypermetropic ametropia exists with vision inferior to 1-4th.

AMBLYOPIA not being a refractive defect and not corrected by glasses should disqualify unless the 1-5th x 3-20th inch test dots be counted at 4.5 m.

AMAUROSIS, an affection of the retina, for a like reason should disqualify.

PTERYGIUM only when it impinges on the cornea should disqualify.

Sixth. The room in which vision is tested should be well lighted and at least 20 feet square.

HEARING.

This is such an important requirement to the recruit for entrance into our service that a few words will not be out of place.

The Epitome of Tripler's Manual, edition 1884, under the caption, "The Ears," says that "Deafness of either ear constitutes an absolute cause of rejection. The applicant should be placed about twelve feet from, and with his back toward the recruiting officer, and be required to repeat certain words, addressed to him in a low tone of voice; his failure to respond will speedily show this defect."

This was modified by circular dated Headquarters of the Army, A. G. O., Washington, June 7th, 1887, as follows:

Strike out paragraphs following "Deafness of either ear constitutes an absolute cause of rejection," and substitute:

"As the distance at which the natural tone of voice may be heard in a closed room, when both ears are normal is about 50 feet, the distance at which the applicant is to stand from the examiner must be as great as the apartments will allow, not to exceed 50 feet.

"The applicant will stand with his back to the examiner, who is to address him in a natural tone of voice. When the distance is less than 40 feet, it should be specified on the examination form, and the tone of voice will be lowered. Failure of the applicant to respond to the address of the examiner will demonstrate a defect.

"The personal attention of the recruiting officer or sergeant must be given to closing the entrance to each ear separately, by pressing with the thumb the small lobe (tragus) situated in front of the opening to the inner ear.

"Advantage should be taken of the absence of other sounds to make the examination. Recruiting officers should remember that a man may be totally deaf in one ear, and yet may hear all ordinary conversation perfectly if the sound ear is not completely stopped. Deafness of one ear is a bar to enlistment, but in ordinary occupations it might not be observed."

The present governing manual of 1893, a revision of former epitomes, orders and circulars, contains all the above with this addition:

"All men enlisted for the Artillery arm of the service at a military post or assigned to that arm from a depot, shall, before such enlistment or assignment,

besides undergoing the ordinary examination, be examined specially with a view to establishing the fact of the patency of the Eustachian tubes and the integrity of the tympanic membranes, in default of which the men are unfit for that arm.

"In time of war deafness of one ear is not cause for rejection. It should be borne in mind that defects in hearing are easily feigned; therefore, when they are alleged by conscripts, the examination should be made by a medical officer. Genuine deafness can not be concealed."

It does not require very careful perusal of what I have just read, to conclude that our methods of testing hearing should be more exact. The room in which recruits are usually examined at rendezvous, vary in size, being rarely over 20 and never 50 feet in any one dimension. Again it is very difficult to so modify the "natural tone of voice" as to give any specific value to it when heard at less distance than the maximum stated. Further, the test of hearing as determined by the voice is not a fair one, hence I suggest the apparatus of Galton, which is most excellent for the exact determination of hearing.

It consists of an india rubber tube which communicates through five others with five fixed whistles of small bore, and at depths that will give 50, 40, 30, 20 and 10 thousand air vibrations in a second, respectively—that is of the several depths of 0.067, 0.084, 0.113, 0.169, and 0.380 inch. Each tube is nipped by a separate clamp. These are numbered in order, 5, 4, 3, 2, 1, and serve as keys. When any one of them is depressed, air is blown through the corresponding whistle, and is thrown into vibrations that can be heard by some as a shrill and pure note, while others hear merely a puff or nothing at all. Every person has his limits of power of hearing high notes, quite independently of the general acuteness of his hearing. The test lies in ascertaining which is the shrillest of the five notes that is audible. The precise limit of audible sound may be found by using a whistle that has a movable plug for its base.

AGE.

At present in our service no particular importance is attached to age and its "physical equivalents" in relation to height, weight and vital (chest) capacity. Much attention has been paid to the relative values of height, weight and chest girth, considered singly and collectively, butnot as connected with age.

Definite rules are given for the determination of certain weights where the heights are fixed; likewise specific statements are made showing the relation of chest girth to height, but one looks in vain for a column of ages to correspond with the physical equivalents mentioned.

In the very earliest days of the Republic, as shown by the Statutes at Large, page 119, vol. 1, the limits of age in the army under Washington were from 18 to 46. During the war with France, in 1798, the age was any that the President might direct. By an enactment of Congress, March 16th, 1802, the maximum age was reduced from 46 to 35, which obtained till January 11th, 1812, when the maximum was again raised and fixed at 45. The war of 1812 arose, and as hostilities became more active, demand was made upon Congress for more troops, so that the Act of December 10th, 1814, called out all "effective men" between the ages of 18 and 50. These limitations were not trenched upon till 1825, when the maximum was again reduced to what it had been twenty-three years before, and became 35. The Mexican war did not change these figures so far as the regular army was concerned, though many volunteers were in the field possessing ages above the maximum stated. During the war of the Rebellion the minimum age was raised to 18 in the regular army, the maximum still remaining at 35. Under the enrollment act, however, the ages were fixed between 20 and 40. The minimum in our service was again modified April 23d, 1874, by War Department Circular, so it became 16. Our present regulations prescribe the minimum and maximum to be 16 and 35, respectively; though the age below 18 is limited to musicians, and between 18 and 21 to those who obtain consent of parents or guardian. By circular dated A. G. O., May 26, 1892, the maximum age was reduced from 35 to 30 for original enlistments, no maximum existing so far as I know, relating to re-enlistments. Some stress is laid by our governing manual upon the fact that for "acceptable colored recruits the age of 25 or 26 is practically the maximum, because after that they are liable to be physically stiffened and mentally dulled."

I should say that about nine-tenths of the original enlistments in our army are between 21 and 30 years of age. The limits fixed for entrance to West Point are 17 to 22.

The consensus of opinion is well put by the lamented Dr. Parkes, of the medical department of the English army, in these terms: "That although a recruit may be usefully *trained* at an early age, no man under 20 can be regarded as an efficient soldier fit for service." Actual experiences of many competent observers confirm this.

The first Napoleon said after the battle of Leipsic: "I must have grown men; boys serve only to fill the hospitals and encumber the roadsides." The Duke of Wellington thought old soldiers the "soul and strength" of the army. General Roberts, in his great march from

Cabul to Candahar in '86, found it was the young soldiers who succumbed, while the old became stronger each day. Sir James McGrigor found the soldier under 20 unequal to the "harrassing duties of service" during the Peninsular war of 1805 to '14. Lord Raglan, the commander-in-chief in the Crimea, found the recruits sent him "so young and unformed that they fell victims to disease and were swept away like flies." The Duke of Cambridge and Viscount Hardinge give like testimony. The Annual Report of the Surgeon-General of the Army for 1885 showed such a marked increase of sickness, and "the rate was so much above the mean for the whole army, "that he questioned whether the services rendered by these young men are equal to the cost of their maintenance."

MINIMUM AGE.

It seems the general opinion that before a recruit has acquired the physical and moral qualities necessary to enable him to execute the duties incident to military life he must have attained a certain age. This should not be under eighteen when the training of the recruit is to commence, and never below twenty as a soldier in the ranks.

The equipment is of such weight that only the strong, healthy and robust can carry it and at the same time render service.

Dr. Fallot says: "Conscripts at the age of eighteen have not attained their full growth, and medical men are well aware that the complete development of the human body requires an exemption from great fatigue, abundance of healthy nourishment, undisturbed sleep and a tranquil mind—a concurrence of circumstances which never occurs in the army."

Coche, in his "De l'Operation Medicale du Recruitment et des Inspections Generales," expresses a similar view, "that recruits at eighteen years of age are commonly unfit for the duties of the army, not only in time of war but in a period of peace." Kirckhoff, who had much experience with troops in active warfare in the Netherlands, says: "We ought to establish it as a general rule not to receive a recruit into the army below 20 years of age or above 25. Under 20 years of age a man has not requisite strength to enable him to undergo the fatigue of military duty, and after 25 his joints do not possess that flexibility or freedom of motion which is necessary for acquiring the discipline of a soldier." He also lays stress upon the fact that only about 5 per cent of the infantry exceed 40 years of age, and that at that time they nearly all become unfit for active service.

Therefore the period of a man's active service, according to this observer, is from the twentieth to the fortieth year.

The above shows conclusively how wrong it is to expect any long continued exertion from the average recruit of 18 or 20 years of age. Again, the constrained position produced by the equipment and the erect attitude which goes to make up the military air and carriage of the soldier differs materially from the conditions surrounding the recreative exercises of the civilian. This has been well put by Parkes, who describes the state of the soldier on the march as the position of "*attention*" *put in motion.*

Is is well to consider the question of metabolism or tissue change in the body, produced by prolonged exercise as in marching, where weight is to be carried. Maclaren of Oxford has given in his work on "Training" as the result of a long pedestrian tour (quite equal to a long march), exceeding 9 hours daily, with knapsack of 12 pounds, the following: "The chest fell from 41 to 39½ inches; the upper arm from 14½ to 13½ inches; the lower arm remained unchanged at 12½ inches; the lower limbs, on the contrary, were vastly increased, the calf of the leg passing from 16 to 17½ inches, and the thigh from 23½ to 25 inches." This, however, is not near so irksome, and not to be compared to the soldier on the march who carries in our service an equipment weighing over five times as much (including gun and ammunition) clothed in heavy uniform, girted with straps and whose pace must be a regulated one, only being allowed to halt at command. The destruction and disintegration of tissue under these conditions are certainly very great and this is usually attended by "partial embarrassment of the system." It is fair to presume that this embarrassment must increase with the weight to be carried, the labor to be performed, hence a glance at our equipment for the infantryman will be of some interest.

The equipment for field service is as follows:

First. The blanket bag, containing two blankets, one pair trousers, one poncho, one shirt, two pairs stockings, one piece shelter tent, one pair drawers, one overcoat, one towel, one pair shoes, one piece soap, etc., the whole weighing 34 pounds.

Second. The haversack, containing the meat ration-can, tin cup, knife and fork, spoon, tin plate, and three days' rations of hard bread, pork or bacon, and coffee and sugar, weighing 9½ pounds.

Third. The canteen, which when filled weighs 5 pounds and 10 ounces.

Fourth. Rifle and bayonet, weighing 10 pounds and 2½ ounces.

Fifth. Field belt and bayonet scabbard, weighing 1 pound and 12 ounces.

Sixth. Seventy rounds of ammunition, weighing 7 pounds and 9½ ounces, being in all over 64 pounds and not including such accessories as pocket knife, money, pipe, tobacco, etc. Of course in time of war this could be reduced, just as in the past. The reduction to forty pounds is possible, but this would necessitate the throwing away of everything except the armament, to which is added one hundred rounds of ammunition and rations for the field to last, say eight days.

This equipment is four pounds greater than that carried by the Roman soldier and 21 to 22 pounds more than of the "old army" of antebellum days.

The efficiency of the soldier is dependent as much on the art of marching as it did in earlier times, and Marshal Saxe and General Fay assert that the secret of the war lies in the strength of "the legs of the soldier." The rapidity of combinations and the celerity of movements, are the best index of the physical efficiency of troops, and we have no better illustration of this than in the armies led by Napoleon the First and well known leaders of the Federal and Confederate armies, during our late unpleasantness.

Inasmuch as the growth of the skeleton preserves a distinct and definite order, it will not be out of place to sketch it hastily during the so-called "military age," from 16 to 30 years, as shown by our best anatomists—Allen, Thomson, Turner, Ellis, and others:

"The epiphyses of the transverse and spinous processes of the vertebræ hardly commence to ossify before 16 years of age and it is not till after 20 years that the two thin circular plates form on the bodies of the vertebræ. The whole process is not completed till near the thirtieth year. The sacrum only commences to consolidate at the eighteenth, and is completed from the twenty-fifth to the thirtieth year. The fourth and third bones of the sternum are only united between the twentieth and twenty-fifth years, and the second is not united to the third bone before the thirty-fifth year. The epiphyses of the ribs commence to grow between the sixteenth and twentieth, and are completed by the twenty-fifth year. The epiphyses of the scapula join between the ages of twenty-two and twenty-five. The epiphysis of the clavicle begin to form between the ages of eighteen and twenty years. The internal condyle of the humerus unites at eighteen, but the upper epiphysis does not join till the twentieth year. The epiphyses of the radius and ulna, the femur, the tibia and fibula are all unjoined at eighteen years and not completely joined till the twenty-fifth year.

The epiphyses of the pelvic bones (crest of ilium, spine and tuberosity of ischium) begin to form at puberty and are completed by the twenty-fifth year." Hence from the standpoint of developmental anatomy we must conclude that the soldier should not be enlisted before twenty. If, however, at an earlier age, his immaturity must be recognized and his training be proportionate to his growth. This is especially true when the effect of *pressure* upon the growing chest and contained organs is considered in connection with the weight of equipment. In moulding bones one of the chief elements in determining shape is pressure. It is admitted by all that the chest does not reach mature growth till thirty. This being the case any continued pressure from before or behind must influence materially its form while growing; especially is this the case at the present time, as the mode of carrying the greater part of the equipment is very unsatisfactory. Many devices have been invented in foreign armies by which the pack is to be carried. These packs are not unlike in size and shape the knapsacks carried during the late war. The weight to be carried in our service, minus the armament, is the aggregate of the contents of the blanket bag, haversack and full canteen, amounting to about 50 pounds. The blanket bag is carried by shoulder straps and the haversack and canteen hang pendant from the shoulders.

The growth of the chest, we have seen, is not completed till 30, that of the heart is still going on at 25 and the lungs have not reached their maximum weight till 30 years of age. It is very evident then, from this, that the question of carrying the equipment is only next in importance to selecting the soldier. All nations except England err in having the pack suspended from the upper part of the back by means of straps, which pass under the arms and over the shoulder. The result is very easy to guess, as two of the "vital tripod," the lungs and heart, become embarrassed by pressure of the straps upon the front, and the pack upon the rear, of the chest. That the principle underlying this is wrong is quite clear, as the weight of the pack should be really thrown upon the loins, or that portion of the back just above the buttocks. With this method the least pressure possible is exerted by the straps of the back upon the front chest. How to do this and at the same time have a simple apparatus, which can be easily put on or off, is a difficult problem. Colonel Merriam, of our service, devised a most excellent pack, the weight being thrown principally upon the loins, but this equipment is so intricate that it almost destroys its usefulness. The English have the pack suspended on a level with the loins by two shoulder straps, which are fastened to the waist-belt

in front. Two additional straps pass under the arms from the knapsack to the straps in front of the body. On the waist-belt in this situation are two full cartridge boxes, which to a certain extent offset the load behind. Much fame awaits the man who shall give to us a simple, easy, comfortable pack.

MAXIMUM AGE.

This varies in our service and is governed by the Adjutant-General. At the present time it is thirty for all arms, although a short time since this only obtained for the cavalry, thirty-five being that for the other arms. My suggestions relative to this are mentioned later.

HEIGHT.

The minimum limit of stature has varied so materially with us since the formation of our army, that it is deserving of special notice. The object aimed at in prescribing this lowest limit has been to exclude such as lack the physical strength necessary to endure the hardships of a soldier's life. These changes have sometimes been brought about by regulations and at other times by law. The act of April 30th, 1790, fixed the minimum stature at 5 feet 6 inches, and this standard was also recognized by act of March 3rd, 1795. The act of July 16th, 1796, however, left this to be determined by the President, which remained unchanged by the acts of 1798 and '99, during the war with France. The old standard of 5 feet 6 inches was again returned to by the act of March 16th, 1802, but during the war of 1812 no limit was fixed, as all "effective men" were taken. No further modification was made till '25, when by Army Regulations the heights of 5 feet 6 inches and 5 feet 8 inches were fixed for the infantry and artillery respectively; these obtained till '38, when 5 feet was made the minimum for all arms of the service. Army Regulations of '41 increased this 5 inches. This held till the Mexican War, when it fell to 5 feet 4 inches and finally to 5 feet 3 inches, by Circular A. G., November 18th, '46. Eleven years elapsed without variation when, in '57, an addition of 1½ inches made it 5 feet 4½ inches. The breaking out of our civil war caused a return to what it had been in '46, 5 feet 3 inches, and this was further reduced by the exigencies of the Rebellion to 5 feet, in '64. This diminutive stature held good till February of '67, when it became 5 feet 5 inches by Circular A G. O., but this was reduced 3 inches in May, and remained so till December the 2nd, when a return was made to what it had been in the early part of that year. The War Department Circulars of August 24th and

October 18, '71, specify that the minimum of 5 feet 5 inches shall apply to cavalry and infantry alike. The following year, '72, a reduction of one inch was made for all branches of the service; this did not last long, for in December it was determined that the cavalry should be governed by what it had been in '71 for that arm, 5 feet 5 inches. In January of the following year this was changed to 5 feet 6 inches for cavalry, and the succeeding month it likewise applied to infantry and artillery. In December of '74 a reduction of two inches for infantry and artillery and one for cavalry was made. Only *one* change has occurred up to the present time, so that the minimum of 5 feet 4 inches for all arms is the fixed standard, exceptions being made in favor of band musicians, school teachers and tailors, who may not fall more than one-fourth of an inch below this.

MAXIMUM HEIGHT.

No maximum of stature was prescribed in our service till December 23rd, 1872, when the limit of 5 feet 10 inches was announced for cavalry recruits; that for infantry and artillery being governed by the maximum of weight, to which should be applied the rule for proportion in height according to the various epitomes of Tripler. In considering these physical equivalents of age, an understanding must be arrived at as to the difference between a "mean" and "an average." According to Sir John Herschel "An *average* may exist of the most different objects, as of the heights of houses in a town, or the sizes of books in a library. It may be convenient to convey a general notion of the things arranged, but an *average* involves no conception of a natural and recognizable central magnitude, all differences from which ought to be regarded as deviations from a standard. The notion of a *mean*, upon the other hand, does imply such a conception, standing distinguished from an average by this very feature, namely, the regular march of the groups increasing to a maximum and then diminishing." The study of those individuals whose physical equivalents are above and below the average is the most important to the examining surgeon, because, here agencies are very significant in modifying the development of the body. The *mean* height is the *typical height possessed by men in groups*: the *average* is the *aggregate* of *all the individuals* in the *groups* divided by the entire number forming them. Height is governed by age, sex, race and those secondary influences of disease, occupation, habits and surroundings, nutrition, food, labor, exercise and rest. A marked difference in height is shown between the laboring or artisan and the non-laboring

or favored classes. Roberts says that between 17 and 25 years amongst the former a difference of two inches is seen, whereas only an inch exists amongst the latter. The mean annual growth among

HEIGHT.

The mean height of the male adult at full growth, compared with mean height at 19 years of age, in various countries.

(From Charles Roberts' Manual of Anthropometry.)

Mean Height at 19 Years of Age.	(25 Years.) Mean Height of Adult.	Difference.
Belgian (Quetelet) 5'5".16=1.655 metres.	5'6".22=1.682 metres.	1".06=027 metres.
American, white (J. H. Baxter) 5'7".07=1.7036 m.	5'8".22=1.7328 "	1".15=0708 "
Criminal classes (Danson) 5'4".94	5'6".30	1".36
Englishmen (Roberts)—		
Laboring class 5'6".5	5'6".5	
Non-laboring 5'8".75	5'9"	0".25
English (Beddoe & Amer) 5'6".577=1.6911 metr.	5'6".6=1.6934 metres.	0".32
Scotchmen (Beddoe)	5'7".5	
Viennese (Liparzik) 5'4".96	5'8".90	3".94
Genoese (Dunant) 1.674 metres.	1.688 metres.	0.014 metres.

the laboring class is two inches at 17 years, and of half an inch between 25 and 30. Another important point is that puberty has a very marked influence on growth, for as puberty approaches there is "an increased rate of growth toward height and an entire cessation of it at 19 or 20 years, in the non-laboring; while in the laboring class growth towards height is less influenced by puberty and is more uniform extending to about the 23rd year. Hence, in the selection of the soldier it is important to bear in mind that there are certain periods of life at which growth towards height is more or less arrested and there are also times of growth more or less rapid than others."—[Quetelet.] I do not think that the differences of growth in height between the non-laboring and the industrial classes obtain here to the extent they do in England and continental countries, yet they are great enough to warrant close study. M. Boudin demonstrated long ago that "no actual relation between mere stature and aptitude for military service" existed. The late Surgeon-General Baxter, in his medical statistics of the Provost Marshal-General's Bureau, found that the ratio of rejections increases with increase of height. Aitken insists that the "taller the recruit the more important it becomes that he should be tested by the spirometer," inasmuch as the majority of the cases of tuberculosis is found in the tall men. It is extremely difficult to fix a uniform standard of height, as the mean stature is found to vary so much under the influence of race. The minimum, where

fixed, should be made to vary with the race. This is well illustrated by this table from Roberts' "Anthropometry," which shows the mean height of the male adult at full growth, compared with the mean height at 19 years of age, in various countries.

WEIGHT.

Quetelet was the first to determine by the study of a larger number (10,000) of individuals of the same nationality of like age and subjected to the same conditions of environment, that the same uniformity as to weight prevailed that had been found to exist as to stature. The weights were found to range themselves into a curve, the well-known binomial curve of Newton. The statistics of weight during the late war were so meagre that they were not worked out, and those collected since, though more accurate, have not been used.

TABLE OF PHYSICAL PROPORTIONS OF HEIGHT, WEIGHT AND CHEST MEASUREMENT.

Modified to correspond to the new increment of weight, 1.85 pounds.

By Captain and Assistant Surgeon Chas. B. Ewing, U. S. A.

Height.	Weight.	Chest Measurement.	
Inches.	Pounds.	At Expiration. Inches.	Mobility. Inches.
64	118.40	32½	2
65	120.25	33	2
66	122.10	33½	2
67	123.95	34	2
68	130.80	34	2½
69	137.50	34½	2½
70	144.50	35	2½
71	151.55	35¼	2½
72	158.20	35¾	2½
73	165.05	36¼	3½

TABLE OF PHYSICAL PROPORTIONS OF HEIGHT, WEIGHT AND CHEST MEASUREMENTS.

(GREENLEAF'S EPITOME OF TRIPLER'S MANUAL, ED. 1893.)

HEIGHT.		WEIGHT.	CHEST MEASUREMENT.	
Feet.	Inches.	Pounds.	At Expiration. Inches.	Mobility. Inches.
5.4-12	64	128	32½	2
5.5-12	65	130	33	2
5.6-12	66	132	33½	2
5.7-12	67	134	34	2
5.8-12	68	141	34	2½
5.9-12	69	148	34½	2½
5.10-12	70	155	35	2½
5.11-12	71	162	35¼	2½
6.	72	169	35¾	2½
6.1-12	73	176	36¼	2½

Our regulations fixed no limit to weight until a few years ago, which, however, remained unchanged till very recently. In '90 the minimum weight of all recruits was fixed at 128 pounds, except for cavalry, in which no limit was fixed, "provided the chest measurement and chest mobility are satisfactory." The maximum for infantry and artillery is 190 pounds for cavalry, and light artillery 165 pounds.

This has been modified so that we find the entire "physical equivalents" that should relate to age *changed by a few lines* in our present regulations, which says that "The following rule for proportionate height, weight and chest measurement is substituted for that on pages 26 to 28 of the Epitome." The rule is: "For each inch of height from 5 feet to 5 feet 7 inches calculate 1.85 pounds of weight; above 5 feet 7 inches add to this standard 5 pounds for each inch of height; minimum chest measurement at expiration from 5 feet to 5 feet 7 inches, half the height plus half an inch; from 5 feet 7 inches to 5 feet 10 inches, half the height; from 5 feet 10 inches upwards, slightly less than half the height; minimum chest mobility, 2 inches."

Upon analysis I can not quite see wherein the rule mentioned can be a substitute for "proportionate height, weight and chest measurement," found on pages 26 to 28 of the "Epitome." The decrease in weight averages about 10 pounds to the inch in height from 5 feet 4 inches to 6 feet 1 inch, but the same rule specifically repeats the manner of determining chest girth previously in force, so that now we

have diminished weight proportionate to height, with a very much increased and disproportionate chest girth. The views formerly held by Aitken, Parkes and others, erroneously however, that the weight in pounds should be about twice the height in inches has seemed to govern our regulations. This decrease of .15 in the increment of weight, seemingly a trifle, is really an average decrease of ten pounds to each inch from the present standard, as shown in the accompanying table.

Study of this table in comparison with the former, of physical proportions in force up to this time, leads to the conclusion that the standard chest girth is much too high for the fixed height and weight. That as it has been found essential to reduce the weight 10 pounds to the inch of height, it must of necessity follow, if the relation of chest girth to the new standard is to be maintained, that it must likewise be reduced. In other words, the physical equivalents, as they relate to age, are not at present true. It is rather difficult to say just how our standard of "physical proportions" was determined. The most important factor, age, has not been taken into consideration and I have hunted far and wide for light upon this subject. A glance at this

HEIGHT AND GIRTH OF CHEST AT EXPIRATION IN ITS RELATION TO NATIVITY AND AGE.

(From Medical Statistics of the Prevost-Marshal-General's Bureau, Vol. 1.)

Americans (White).	Number Examined.	Mean Height.	Mean Girth of Chest.
All ages	190,621	67.69	33.59
Under 20 years	46,855	66.57	32.24
20 and under 25	52,393	67.82	33.55
25 and under 30	31,757	68.10	34.06
30 and under 35	23,174	68.22	34.28
35 and under 40	20,692	68.30	34.48
40 and over	15,750	68.23	34.67
Americans (Colored).			
All ages	19,379	66.66	33.88
Under 20 years	5,072	65.61	32.59
20 and under 25	5,960	66.80	33.93
25 and under 30	3,147	67.17	34.52
30 and under 35	1,784	67.22	34.61
35 and under 40	1,731	67.26	34.67
40 and over	1,685	67.18	34.76

British Americans.	Number Examined.	Mean Height.	Mean Girth of Chest.
All ages	14,365	67.14	33.59
Under 20 years	2,950	66.10	32.28
20 and under 25	6,231	67.26	33.58
25 and under 30	2,504	67.53	34.18
30 and under 35	1,152	67.65	34.32
35 and under 40	961	67.65	34.50
40 and over	567	67.49	34.76
Englishmen.			
All ages	9,649	66.59	33.48
Under 20 years	1,073	65.69	31.96
20 and under 25	3,456	66.54	33.18
25 and under 30	1,899	66.87	33.83
30 and under 35	1,218	66.92	33.93
35 and under 40	1,156	66.74	34.17
40 and over	847	66.70	34.21
Irishmen.			
All ages	28,995	66.75	33.85
Under 20 years of age	3,322	65.94	32.26
20 and under 25	11,626	66.80	33.54
25 and under 30	5,694	66.93	34.30
30 and under 35	3,152	66.97	34.54
35 and under 40	3,031	66.91	34.58
40 and over	2,176	66.78	34.74
Germans.			
All ages	29,600	66.53	34.01
Under 20 years	2,343	65.69	32.17
20 and under 25	6,032	66.54	33.59
25 and under 30	5,384	66.75	34.19
30 and under 35	5,126	66.67	34.29
35 and under 40	6,115	66.59	34.36
40 and over	4,600	66.45	34.40

table compiled from data from Baxter's Work of the Provost Marshal-General's Bureau, shows that the height and chest girth of all the nationalities differ in their relation to age. The data consists of over half a million accepted recruits, "under the age of twenty" and up to "forty and over." Here we find without exception all showing less chest girth in relation to height than our present standard. Another very important deduction is that our fixed weight of former regulations, now very materially and sensibly changed, was far in excess of that shown upon actual demonstration by this table, but to be consistent the chest girth should be diminished proportionately.

One of the ablest authorities, Charles Roberts, says, "that for each inch in height the weight is increased 4 pounds from ten to fifteen years; 6 pounds from fifteen to sixteen; 8 pounds from sixteen to nineteen, and from nineteen to thirty years of age there are 6 pounds added to the weight, while the height remains stationary." While this may be true for the inhabitants of England, these figures would hardly govern here with our population of mixed nationalities.

WEIGHT.

Variation of Weight with Age of same Stature.

(From Aitken.)

Stature.	Weight at 18.	Weight at 19.
67 inches.	126 lbs.	138 lbs.
66 "	120 "	130 "
65 "	116 "	121 "
64 "	115 "	120 "
63 "	117 "	117 "
62 "	111 "	113 "
61 "	102 "	119 "

Weight is the least reliable, however, of all the physical equivalents of age, being influenced more by accidental causes than chest girth or height. A healthy environment, abundance of food and good digestion favor an increase of weight. This is particularly noticed in comparing the mean weight of the English laboring and non-laboring classes, where in the former at 17 years of age you have a mean of 116, as compared with 140 pounds in the latter, and 128 as compared with 148 pounds at 19 years of age.

THE RELATION OF WEIGHT TO AGE.

Aitken says, after 9 years of age an increase of weight begins, so at 16 we have an increase of 16 pounds for that year. From 17 to 23 or '4, the rate of increase diminishes till 30 is reached; after 30 adipose is taken in rapidly and weight increases. The late Surgeon-General Baxter, in his work, fixed the increment of weight between 61 and 71 inches of stature at 5.96 pounds. Hutchinson's results show 5.14, and Gould 4.25 pounds, making an average of 5.07 pounds. I have mentioned the erroneous idea that two pounds for every inch of stature constituted a sound body, also that our increment has been changed to 1.85 pounds to the inch, with the additional 5 pounds above 5 feet 7 inches. That weight varies with age in youths and men is graphically shown by this table from Aitken.

CHEST GIRTH.

Some difference of opinion exists as to the best manner of obtaining the chest girth. Tripler contends that the tape should be placed below the nipple in front, which behind would carry it beneath the point where the latissimus dorsi springs from the trunk. He holds that in this way a more exact measurement is made, because you do not include the mammæ, nor the pectorals and latissimus dorsi muscles in your measurement. This has not been thought worthy of adoption, however, so that in our service the tape is passed around the chest over the inferior angles of the scapulæ and directly above the nipples, the tape being pressed evenly. Measurements are to be taken both at expiration and inspiration. Chest mobility is one of the best criterions of endurance and fitness for continued exertion. American statistics of the white natives, by Surgeon-General Baxter, and those of Balfour of the English army, show a regular relation of chest girth to height, though other authorities do not think that this has been definitely determined. The agencies, environment and

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AVERAGE HEIGHTS, WEIGHTS AND CHEST GIRTHS,

With minimum of latter and annual rate of increase from 17 to 30 years of age from public schools, naval and military cadets, medical and university students, i. e., well-favored non-laboring classes.

(Modified from Aitken on Growth of the Recruit.)

Height in Inches, Without Shoes.			Weight Including Clothes 7 to 10 Lbs.		Empty Chest Girth, In Inches.		
Age last Birthday.	Average.	Average Annual Growth in Inches.	Average.	Average Annual Growth in Lbs.	Average.	Minimum.	Average Annual Growth in Inches.
17	67.84	1.46	141.03	12.69	33.98	27.5	0.90
18	68.29	0.43	146.0	4.97	34.44	29.5	0.46
19	68.72	0.43	148.20	2.20	34.77	29.5	0.33
20	69.13	0.41	152.07	3.87	35.25	29.5	0.48
21	69.16	0.03	152.34	0.27	35.42	30.5	0.17
22	68.93	....	154.78	2.44	35.30	30.5	....
23	68.53	....	151.70	....	35.50	30.5	0.08
24	68.95	....	149.20	....	36.10	31.5	0.60
25 to 30	69.06	....	155.20	0.42	35.96	30.5	....

AVERAGE HEIGHTS, WEIGHTS AND CHEST GIRTHS,

With minimum of latter and annual rate of increase from 17 to 30 years of age, among the artisan or laboring classes of the English population.

(MODIFIED FROM AITKEN ON GROWTH OF THE RECRUIT.)

Height in Inches, Without Shoes.			Weight Including Clothes 7 to 10 Lbs.		Empty Chest Girth, In Inches.		
Age last Birthday.	Average Weight.	Average Annual Growth in Inches.	Average.	Average Annual Growth in Lbs.	Average.	Minimum.	Average Annual Growth in Inches.
17	64.45	1.52	116.4	7.66	29.38	24.5	9.0
18	65.47	1.02	123.3	6.97	30.07	25.5	0.5
19	66.02	0.55	128.4	5.08	30.56	26.5	0.5
20	66.31	0.29	130.6	2.20	30.86	26.5	0.5
21 to 22	66.60	0.29	135.4	4.81	31.61	29.5	0.5
23 to 30	66.68	0.08	139.0	3.58	32.38	29.5	0.5
23 to 50	66.65	....	141.2	5.74	32.62	29.5	0.5
Dawson.	66.39	....	143.7	....	....	....	....
Beddoe.	66.72	....	137.7	....	....	....	....

AVERAGE AND MEAN EMPTY CHEST GIRTH,

And annual rate of increase of lads and men between and inclusive of age from 17 to 30 years of age, of English favored. i. e., non-laboring classes.

(FROM CHARLES ROBERTS, F. R. C. S.)

Age at last birthday	17	18	19	20	21	22	23	24	25 to 30
Number examined	1,513	1,433	811	408	347	207	87	46	67
Average chest girth	33.98	34.44	34.77	35.25	35.42	35.30	36.10	35.96	.....
Average increase	0.90	0.46	0.33	0.48	0.17	.....	0.60	.....	.....
Mean chest girth	34.	34.5	34.75	35.	35.25	35.5	35.75	36.	36.
Mean increase	1.0	0.5	0.25	0.25	0.25	0.25	0.25	0.25	.....

AVERAGE AND MEAN EMPTY CHEST GIRTH.

And annual rate of increase of 918 men and lads, from ages of 17 to 50 years, among the artisan or laboring, i. e., least-favored class of English population.

(FROM CHARLES ROBERTS, F. R. C. S.)

Age at last birthday	17	18	19	20	21 to 22	23 to 30	23 to 50
Number examined	376	168	90	46	45	88	105
Average chest girth	29.38	30.07	30.56	30.86	31.61	32.38	32.62
Average increase	0.41	0.69	0.49	0.30	0.75	0.77	0.24
Mean chest girth	29.5	30.0	30.5	31.0	31.5	32 0	32.5
Mean increase	1.0	0.5	0.5	0.5	0.5	0.5	0.5

occupation. have produced marked differences as observed in the favored or non-laboring and laboring classes of England, by Charles Roberts. The tables are appended and well worth study.

Hutchinson says that three inches is the mean mobility of a healthy chest, and further asserts that "the vital capacity is the same in all men of the same stature." Vital capacity he terms "the most complete voluntary expiration immediately following the most complete inspiration."

Both of these propositions are untrue. As regards the first, I have seen many very healthy men with a less mean than three inches, and as to the second, it would be absurd to say that Sandow "the Strong Man", with a chest movement of nine inches, possesses no more vital capacity than other men of his height, (5 feet 8 inches) who have only a chest movement of 2½ or 3 inches. Hutchinson further says that "vital (chest) capacity" increases 8 cubic inches to each inch of stature from 5 to 6 feet and, therefore, chest mobility increases and decreases with the height, according to an arithmetical progression. The latter proposition is now held to be true within reasonable limits of error, hence. I hope that our chest girth will be reduced to conform to the recent standard of weight given us.

All of these physical equivalents are so important in their relation to age that I suggest that our tables be entirely revised, and that data be obtained from statistics collected by recruiting officers since the war, in which much care has been taken in determining weight, together with the other physical equivalents.

HEMORRHOIDS.

Our regulations say they "may be recent or old. If recent they will appear about the size of a buck-shot, of a bluish color, hard and tense to the feel and their covering will look thin. If old they will probably be as large as as a marble, of a brawny feel, reddish brown color and have a thick covering. If *recent*, as above described, they are not *cause for rejection*, neither are they if *old* and *single*, and the applicant asserts they have never been painful or troublesome; but if there should be *more than one old pile* and they are larger than described, or if a *single old pile* is ulcerated or inflamed, or if there is a *small pile* associated with varicose veins of the legs, the applicant should be rejected." Thus you see we draw a very fine point on the age and size of piles. Comment here is hardly necessary. If this regulation simply governed the recruiting officer it might be well and good, but it applies equally to the examining surgeon, hence, I believe these gross pathalogical distinctions should be stricken out, so far at least as they concern the surgeon, permitting him to exercise

his judgment and knowledge of morbid conditions. I know of many good men rejected by reasons of this peculiarly worded paragraph.

VARICOCELE.

This is so much the bane of the depot surgeon's existence that I can not pass it by without a few words. The regulation says "the rule formulated by Tripler, which if strictly followed will exclude from the service men thus physically unfitted." The rule is as follows: "If the testicle upon that side is atrophied (shrunken), whatever may be the volume of the cirsocele (varicocele), or if the volume of the latter exceeds that of the former, the recruit should be rejected, that is, the varicocele should not be greater in bulk than the sound testicle." Such a large number of recruits are rejected annually for varicocele that this is deserving of special consideration. This antique dictum has resulted in so much injury to the service that I can not forbear comment. No other service in the world has such a regulation as this, where the examining surgeon turns himself into a pair of scales, balancing a testicle in one hand and a collection of varicose veins in the other, hoping to determine their respective size and weight, which to say the least is a method unscientific and unbecoming. Much stress has been laid upon atrophy of the testicles, as if varicocele was the only cause of that condition. This is rather absurd, as it is well known that excessive venereal indulgence or masturbation will cause atrophy. In fact, any cause which causes pressure on the spermatic cord, thus influencing the nerve supply to these organs, will produce atrophy. I have seen the continuous use of a suspensory bandage do this, and it is well known that it arises from paraplegia, injuries of the spine and cranium, and orchitis from injury or mumps. Professor Halstead of Johns-Hopkins, agrees with me in believing it not unfrequently due to chronic gonorrhœa, where the inflammation has extended to the testes destroying the function of those cells necessary to growth of the organ. Again, what if the testicle is atrophied? A soldier is not enlisted because of his procreative power, and I have failed to find a single instance where a diminution in size of the testicle has caused loss of strength or stamina in him.

Surgeons Henderson and Marshal, both of large experience, at home and abroad, have never seen a man report sick from this cause. Assistant Surgeon Coolidge says, "some degree of cirsocele is very common, and if men are to be rejected for this affection indiscriminately, our rendezvous might almost as well be closed." Humphrey says that this condition occurs once in every ten males. Of 166,317

recruits inspected in Great Britain and Ireland during ten years, 55,474 were rejected and 3,911 or 70.5 per 1,000 for varicocele. Of 2,165,470 recruits examined in France, for a period of ten years, 20,553 or 10.05 per 1,000 were exempted for varicocele. During the late war there were recorded 7,270 cases of varicocele, but then we must consider the very large number of men in the field of various sizes, ages and conditions. It is generally admitted that very few cases of varicocele require operative interference and when performed it is not so often to relieve the pathological condition as it is to minister to a diseased imagination. In my twelve and one half years' experience in the service I have only seen a single case of varicocele upon sick report. I think this condition more common than we have been lead to suppose and we would enlist very few, if held to the strict meaning of the term.

ENLISTMENTS AND REJECTIONS.

For the past five years enlistments have been made at rendezvouses of the general and mounted services as follows:

Fiscal year ended June 30th, 1889	6,637
Fiscal year ended June 30th, 1890	4,941
Fiscal year ended June 30th, 1891	4,591
Fiscal year ended June 30th, 1892	5,018
Fiscal year ended June 30th, 1893	5,109

The total number of rejections during each of the past five years was as follows:

Fiscal year 1889	18,694
Fiscal year 1890	16,877
Fiscal year 1891	17,377
Fiscal year 1892	17,244
Fiscal year 1893	14,944

CONCLUSIONS.

First. That the rules and regulations governing the Examining Surgeon, in the physical examination of the recruit, be separate and distinct from those that govern the Recruiting Officer, who is not a medical man.

Second. That the room in which examinations are to be made should not be less than 20 feet square, well lighted and ventilated.

Third. That the unit of measure be as small as possible and that the metric system be used.

Fourth. That the recruit be measured in the horizontal instead of the upright position, as at present, so that the large number of men now rejected as being below the standard, be saved to the service.

Fifth. That this method of measurement be used so that the exact value of height be obtained in its relation to the other physical equivalents of age, as they are governed by nativity.

Sixth. That weight be determined by a uniform system, the metric, and that the apparatus consist of scales of the simple bar and weight pattern rather than the old style.

Seventh. That special pains be taken to fix this physical equivalent, so that its proper relation to height, and age could be determined, for each separate nationality.

Eighth. That the chest girth be changed to conform to the present standard of weight and height.

Ninth. That special attention be given this, so that proper ideas may be obtained in the relations of this "physical equivalent" to weight, height and age, as it affects each particular race in this country.

Tenth. That data be collected from our present statistics in relation to age, height, weight, chest girth, chest expansion and capacity of each separate nationality, so that a better and more exact basis of selecting the recruit could be made.

Eleventh. That the spirometer, or some modification of it, be used as an aid in determining vital chest capacity, also that calipers be authorized so as to measure depth of chest.

Twelfth. That the present method of determining hearing be modified as I have indicated.

Thirteenth. That the test for vision be changed as before mentioned, and that the prisoptometer be placed in general use for the determination of simple refractive defects.

Fourteenth. That it be no longer obligatory to determine with such exactness the age and size of piles, but that this condition be left to the discretion of the surgeon.

Fifteenth. That the paragraph relating to varicocele be expunged, as our present instruments of precision can not measure the fine pathological distinctions insisted upon.

Sixteenth. That the *physical* as well as the *actual age* of the recruit be entered by the Examining Surgeon upon our examination forms, thus arriving at a closer determination of those equivalents which fix the limits of the "military period" of service.

MEDICAL DEPARTMENT OF THE ARMY.

By Major Charles Smart,
Surgeon, United States Army.

Of late years the relative importance of certain duties of the military surgeon has undergone a material change. Formerly the care of the sick and wounded was his all-important duty; he was a military general practitioner. Now the preservation of the health of the troops is his first care; he has become a military sanitary officer. The framers of the Army Regulations of 1818 had the wisdom to provide that when troops were in quarters the surgeon should from time to time inspect the rooms and kitchens, quality and preparation of the food, and the location and condition of the vaults, reporting defects and suggesting improvements to the commanding officer, who was directed thereon to issue such orders as he might think necessary and proper. This was the entering wedge which split up the massive ignorance and despotic rule that came to us from the days of feudalism. It is true that earlier regulations required the surgeon to do all in his power to prevent and eradicate contagion—but this was aimed at hospital contagion—hospital gangrene among his wounded and hospital fever, the redoubtable typhus, among all classes of hospital inmates—and gave him no power over the general well being of the troops. For a long time the provision which made the surgeon a sanitary inspector was a dead letter. He fulfilled the requirements of the regulation by inspecting and reporting until he became tired of being treated as officious and meddlesome by commanding officers who resented this performance of duty on his part as a reflection on their efficiency, and who never considered it either right or proper to issue orders on his recommendation. In the course of time, however, the progress and popularization of sanitary science were such that commanding officers did not dare to pass unnoticed the suggestions of their medical officers, and as a consequence sickness become less prevalent. and the military physician had more time to study practical sanitation. At last it became recognized generally that prevention was better than cure, and the army medical officer ceased to be primarily a general practitioner in becoming the administrative officer of a sanitary bureau with certain clinical duties when accident or the failure of preventive methods placed the individual soldier for special care in a hospital ward. To appreciate what the army surgeon has accomplished as a sanitary officer it is only needful to consider a brief extract from the records of Baton Rouge, La. This, a large post of 400 or 500 men.

lost by death annually an average of 210 men per thousand of strength during the six years—1819–24. In the year of greatest mortality, 1822, the loss was 260 per thousand; nor was any great epidemic sweeping its tens of thousands from the face of the country during these years; the citizens of Baton Rouge in the vicinity of the military post were healthy. Could such a thing happen in these fin de siècle times during a period of piece and prosperity? In reply it need only be said that the mortality of the United States Army from all causes in 1891 was 8.05, and the average annual rate of the previous decade 8.82 per thousand living. This preservation of men from sickness and death has been accomplished by the medical officers of the Army in the face of many difficulties, chiefly attributable to ignorance and its narrow-minded economies. These he has fought earnestly and perseveringly. He has been defeated time and again, yet has always returned to the struggle as soon as the progress of time and science had reinforced him with fresh data bearing on the point of attack. It may perhaps be said that in developing his status and power as a sanitary official the military surgeon became less attentive to his duties to the individual; that his ability as a sanitarian was purchased at the expense of his experience as a practitioner. To discuss this point is beyond my present province; but I am willing to admit that had all the energies of the Army Medical Department which have been expended in lessening rates of sickness and mortality been devoted to perfecting a system for the care of the wounded in battle, a medical officer in discussing this subject at the present time would have been able to speak from a platform of better considered and selected ideas than now supports our methods of field management. I must not here be understood as meaning that during the years of sanitary progress no attention was given to the responsibility that would fall upon the Medical Department in the event of war. On the contrary, the great War of the Rebellion demonstrated that an efficient system for the care of the wounded was one of the grand divisions of military sanitation; and continued efforts have been made to build up our methods on the foundation of experience which we then gained. That war enlarged our views, and it lasted long enough to enable us to develop a system based upon the enlargement, and to show us what was needful to the successful carrying out of the system. We began the war with methods borrowed from Europe. We ended with methods that were developed by the cries of our wounded for relief. We realized that to enable a Medical Department to care properly for the wounded of an army it must have full control of all the men and material need-

ful to this end. At first the Quartermaster Department had control of the ambulances and medical wagons, and nothing could be done by anxious medical men without efficient co-operation on the part of the other officers; and as the litter bearers and nurses were subject to the orders of regimental commanders many a medical officer found himself in the early days of the war with no hands but his own to give succor to the wounded on the battlefield. These difficulties were overcome during the progress of the war by makeshift organizations and the co-operation of general officers in command of divisions and corps; but on the return of peace medical methods retrograted to their antebellum status or that prescribed by the Army Regulations of the time. This was so unsatisfactory to those who saw clearly the difference between what was and what might and should be, that every effort was made to reorganize the Medical Department in accordance with the experience of the war, that the fruits of that terrible ordeal might not be permitted to decay for want of care and storage. Difficulties were encountered. The country had been surfeited with war; Congress was slow to move in anything that looked like building up the armed power; so that it was not until twenty-one years after the close of the war that the Medical Department of the Army was authorized to provide itself with that which the war had shown to be indispensably necessary to the proper care of the wounded, viz., a body of men specially trained for the performance of this particular work.

In 1887 a law was passed establishing a Hospital Corps, and since then the best energies of the Department have been devoted to educating the personnel and perfecting the organization of this Corps, and formulating the methods by which it will accomplish its work not only under conditions of peace but under those of Indian or of modern warfare.

The recruit for the Hospital Corps is selected and enlisted by the medical officer; or, if he enter the corps by transfer from the line, it is on the application of the same officer. Hence, if the department fail to have suitable men, physically sound, mentally capable and morally trustworthy, the fault will lie with its own officers. How different this from the previous status when medical officers had to do what they could for the injured, with such men as nurses and assistants as a commanding officer was pleased to place at their disposal. The recruit is then sent to a post or company of instruction for drill, discipline and education. At present there are two companies of instruction—one at Fort D. A. Russell, Wyoming, the other at Fort

Riley, Kansas. Here all are set up as soldiers and are taught the practical details of first aid to the wounded and the principles of nursing. Those who manifest a predilection for a special line of work have every facility afforded them for developing their usefulness. Some give special attention to cookery, others to pharmacy, others again to the symptoms, progress and management of disease, while the more intelligent and ambitious of the men extend their course of study with a view to becoming hospital stewards.

The system of Hospital Corps drill was elaborated with much conservatism. Many medical officers, particularly those of large experience in actual war, and whose views carried corresponding weight, were opposed in toto to any system of drill. Litter drills were known to have been a failure in the Army of the Potomac at Falmouth, Va., in 1862-3, but this was not surprising considering the circumstances. The men then attached to the hospitals looked upon the proceedings with dummy wounded as a kind of a joke—an amusement to relieve the tedium of winter quarters. They had carried wounded men from the field at Yorktown, during the seven days in front of Richmond, and but a short time before from the lines of battle at Antietam and from the foot of the impregnable heights of Fredericksburg, and they naturally regarded this make-believe work as illustrating the stupidity of those in authority who sent young assistant surgeons, to whom the whistle of a passing bullet was as yet an unknown sound, to superintend the field work and teach them how to handle wounded men.

There was, moreover, a prevalent opinion that the gentle handling of a wounded man was inconsistent with the sharp tones of military command, and that any attempt to coördinate them would bring ridicule on the medical officers concerned in it. At the same time it was recognized that there was no better method than drills by word of command to perfect men in movements that required concerted action. A well-manned battery keeps up a rapid fire because every man knows the duty devolving upon him and does it without command at the precise moment when it should be done; but this perfection of co-operative work is attained only by repeated and careful drills in the consecutive movements, each executed at the word of command. An analogous drill with the litter, ambulance, and a representative of the human body familiarizes men with the management of these objects and prepares them to act intelligently one with the other and irrespective of commands when the necessities of the occasion require such action.

Several years were spent in perfecting the drill. Provisional manuals were issued for the guidance of officers with authority to deviate from the prescribed lines whenever they thought an advantage was to be gained. Now the approved Manual contains the best thoughts and experience of the earnest and active workers of the Medical Corps of the Army. The best methods of handling a wounded man are laid down. The members of a litter squad, drilled in these methods, will at a word from their chief take each his proper position and be en route from the field with their burden before an equally intelligent but undrilled set of men would have decided upon the best way of lifting the injured man for transference to the litter. All the soldiers of the Hospital Corps are taught their duties as members of the litter squad, to lift and carry in the best position, to relieve shock, stem hemorrhage, dress wounds, extemporize supports for fractured bones, and deal properly with unconscious patients whether the insensibility is due to injury, as in concussion or compression of the brain, to syncopic conditions, as in fainting, shock and loss of blood, or to congestive conditions, as in strangulation, drowning, asphyxia from noxious fumes, apoplexy, sunstroke, convulsions or narcotism from alcohol, opium, exposure to cold, etc. All are taught also the duties of hospital ward routine and the principles of nursing as constituting with their knowledge of first aid the complete curriculum of their technical education.

When a soldier has reached this stage of his development he leaves the school of instruction for duty at a military post where he is not permitted to forget what he has learned, and where, if he is able and ambitious, he will find every facility for advancing himself in knowledge, usefulness and position. After not less than a year of service as a private soldier he is eligible for assignment as an Acting Hospital Steward, provided he demonstrates his fitness for the position by passing a satisfactory competitive examination in arithmetic, Army Regulations, pharmacy, materia medica, first aid and hospital corps drill. Having gained this position and held it for a year he becomes eligible for promotion to the grade of Hospital Steward, provided he can show a satisfactory advance in the subjects above mentioned and a competent knowledge of minor surgery and the principles of military sanitation. The current duties of the Medical Department at a military post are performed by these men while studying to prepare themselves for any duties or responsibilities that the accidents of peace or the emergencies of war may bring upon them. The Acting Hospital Steward gives special attention to the education of the private soldier.

The Steward develops the powers of his Acting Stewards and exercises a general supervision. Every member of the corps endeavors to bring those below him to his level, and the medical officer directs the whole, giving lectures, demonstrations and drills to familiarize the men with the management of emergencies and the application of field methods. To permit these drills to be carried out, and at the same time to provide for accidents and the medical needs of the post, ambulances are allowed in proportion to the strength of the garrison, and these are under the immediate control of the medical officer, who is responsible that they are always fully equipped and ready for service.

The Hospital Corps is, as has been indicated, a self-educating body. It is the duty of the member who has been promoted to give a helping hand to those below him, and no jealousies interfere with its discharge because rank goes by seniority, and the man who is now climbing can never antedate the man who is helping him. The members are possessed of all the facilities afforded by books, dispensaries, wards, surgical appliances and medical education. Every term of enlistment is a course of study giving greater value to their services by their increased experience. The records of their examinations show the progress made in their education. The prize for worthy members is promotion to the dignities, responsibilities and emoluments of a stewardship; and this is highly appreciated because it is always before the eyes of the candidates in the person of the steward under whose command they perform their duties. With this ever-present stimulus it is not surprising that as the result of a year's study of pharmacy and materia medica these eager and ambitious young men know more of these subjects than medical students who have taken their regular college course but whose only stimulus is a medical degree with all sorts of uncertainties attending its future possession.

There are now in the United States service, educated in the manner described, 119 stewards, 88 acting stewards and 607 private soldiers. Besides these there have been educated 39 stewards, 29 acting stewards and 778 privates who are not now in the corps, having obtained their discharge or declined re-enlistment. Most of these stewards left the army because, with their qualifications, they believed they could do better for themselves in civil than in military life. The army system carried their education so high that their services became lost to their teachers. Many of them are now practicing physicians; but should a call to arms be sounded by the country these men would undoubtedly be prompt to respond. The enormous percentage of

loss by refusal of the private soldiers to re-enlist was due to dissatisfaction with the pay roll. From the passage of the organizing act until recently the pay of the Hospital Corps soldier was no more than that of the soldier in the ranks notwithstanding the importance and special character of his duties. He declined to re-enlist in the corps unless he was looking forward to his advancement therein, in order to accept service in the line where immediate promotion and increased pay were secured by his intelligence and reputation. Now, however, that the pay of the private of the Hospital Corps has been made equal to that of a non-commissioned officer of the line, there will be less of a movement from the corps. Those educated by it will be satisfied to continue in its service.

It has been said of the educational work of the Medical Department that it is carried to excess, and the loss of certain hospital stewards above referred to has been instanced as proof. No doubt many of our Hospital Corps soldiers would do their duty as satisfactorily as litter bearers and ambulance drivers although they knew nothing of many other subjects that form part of their educational course. It must be remembered, however, that the corps as a whole is a preparation for war, and that should war unfortunately occur and cause a sudden expansion of our military forces it is on the education of these men that the usefulness of new undrilled and uneducated additions to the Hospital Corps would depend.

Something must now be said concerning the personnel of the Medical Department. This consists of a corps of medical officers who enter the service by competitive examination, and are therefore promoted by seniority, provided they continue to fit themselves for the increasing responsibilities of higher positions. As with the Hospital Corps so with its corps of medical officers; the Medical Department is itself responsible for the character and qualifications of its members. A board of medical officers selects its approved candidates from those who come forward for examination. Political influence, which has so much to do with appointments to the U. S. Military Academy, to the army from civil life, and to the staff corps from the line, is utterly powerless in appointing or promoting the medical officers of the army. The members of the examining board, jealous of the good repute of their corps, allow admission to none whose professional attainments are not such as to promise a satisfactory future record. These examinations were instituted during the War of the Revolution, and their continuance to the present day has kept the corps free from the demoralizing effects of political and social influence. In

the present age, which may be called that of examinations for public positions, there is little likelihood of any relaxation of the strictness of these inquiries into the fitness of candidates for appointment.

The passed candidate, now a medical officer with the rank of lieutenant, is required to attend a course of four months at the Army Medical School in Washington, D. C., during which he is instructed in subjects that are not at all or imperfectly dealt with in the usual college curriculum. He is taught Army Regulations and customs of service, the rights, privileges and property responsibilities of officers, examination of recruits, reports of sick, methods of post hospital administration, of feeding, clothing, equipping companies of the hospital corps, and the care and transportation of the wounded and field hospital management. He is taught also clinical and biological microscopy, particularly as bearing on disinfection and prevention of disease, military hygiene and practical sanitation, that he may be able to give an expert opinion on all questions relating to the health of the command to which he may be attached. After this he is placed on duty usually at first at a large military post where he is subordinate to an officer of considerable experience, and where he becomes familiar with the duties of his office, including the drill and discipline of detachments of the Hospital Corps. The Army Medical School is a new institution recently established by Surgeon-General Sternberg. The first session will begin in November next. It is understood that the faculty will consist of Colonel Chas. H. Alden, President, duties of medical officers; Lieutenant-Colonel Wm. H. Forwood, military surgery; Major John S. Billings, military hygiene, with Major Charles Smart as associate in charge of the practical work in sanitary chemistry, and Captain Walter Reed, clinical and bacteriological microscopy.

At the end of a five years service he is promoted to a captaincy, having first undergone an examination to determine his fitness physically and intellectually, for the performance of the duties of the grade to which he is to be promoted. The professional part of this examination is more military than medical. After this the Army medical officer remains undisturbed by examiners for ten or fifteen years, or until his seniority brings him near the head of the list of captains, when he has to show to an examining board that his physique is still good and that he has kept up with the progress of modern medicine. Recently Surgeon-General Sternberg has favored those officers who are nearing the period of examination for their majority by assigning them for a year to duty as attending surgeons in such cities as New York, Chi-

cago, Philadelphia, Boston, etc., so that they may take advantage of the hospital practice, lectures on special subjects and meetings of active medical societies. The Army medical officer is thus kept well informed in his profession throughout the whole period of his service on the active list; for after having passed all his own examinations he may be assigned to the duty of examining others.

The members of the Medical and Hospital Corps are attached to other military organizations but are bound up with none. They are subject to the commands only of their superiors in their own corps under the authority of commanding officers, and are all, with their equipments, property and transportation, under the control of the Surgeon-General by virtue of the authority of the Secretary of War. The hospital corps soldier is not enlisted for a specific duty, but may be employed to utilize his special qualifications to the best advantage, as a litter bearer or an ambulance driver, cook, nurse, ward master or orderly; the members of the Medical Corps may in like manner be placed on duty in command of ambulance or bearer companies, at collecting stations in the field, as operating surgeons, attending physicians, quartermaster and subsistence officers of hospitals, purveyors of medical supplies, inspectors, directors, etc. If the square peg is put in the round hole it is the fault or mistake of the management. Moreover, although the personnel and material of the department are based on the strength of military organizations as so many ambulances, etc., to a regiment of so many men, no part of the medical outfit has any connection save that of temporary attachment for duty with the regiment or other military subdivision. If one regiment suffers more than another a suitable increase of medical strength can be placed at its service. In fact, the full strength of the department can be thrown where, in the opinion of the Medical Director, it is most required. If anything is lacking in an emergency the failure must be attributed to want of foresight on the part of the medical officer in authority. Duty is well performed when responsibility is clearly defined and power delegated adequate to its support. Often and sorely was this realized by medical officers during the War of the Rebellion, as when all that had been provided for the wounded in a great battle was as if it never had been provided, because the Medical Department did not control the wagons which carried those invaluable supplies. All this is now changed, and under present laws and regulations there is every reason to anticipate that in the inauspicious event of active service for the military forces of the United States its Medical Department would be distinguished for its excellent work.

It is recognized that in time of war the main reliance of the country would be the State troops mustered into the service of the United States. These, uniformed, equipped, drilled, disciplined and organized in accordance with the regulations of the United States Army, would speedily become assimilated with the regular troops and form with them a national army. Similarly should the Medical Department of the National Guards be organized after the methods of the Army Medical Department, for it is as needful forthe care of the sick and wounded of a large army that its medical officers be trained by the same methods as it is for the military success of the command that each of its component organizations shall have been taught the same system of military tactics. Were the methods of the Medical Department of the State military organizations the same as those of the United States Army the latter would have no difficulty in providing for the exigencies of war, for each accession to the strength of the army would bring with it its proportionate number of medical officers and soldiers of the Hospital Corps. Unfortunately few of the States have as yet recognized the necessity for making any change in their medical service. Regimental methods in use in the days of the Revolution answer their purpose excellently in times of peace. The medical officer of a regiment lives in the same city or locality with its officers and men. He is always on hand if an accident occurs; in fact, he is a kind of family physician to the command. He is present at sick call when the regiment is in its summer camp; and when it is called out for local service in strikes he and his assistants and his detailed men have usually no difficulty in caring for the resulting casualties. The regimental system of medical service suits the existing conditions of the State military organizations. Their medical officers credit the Army medical officer with understanding his own businesss but think that he fails to appreciate the wholly different conditions existing in the State services. They consider him right in organizing a general staff corps for assignment to duty with parts of regiments scattered in garrisons all over the country, but hold him wrong in insisting on the adoption of his methods by the State authorities. They attribute his insistence to his ignorance of their local conditions and of the convenience of their regimental methods. In this lies their mistake, he is fully aware of these; but regards them lightly in comparison with the more important duties of war service. The raison d'être of a military medical department is not to care for sick and injured men in times of peace. That could easily be arranged without a Medical Department. It is to have on hand a

trained body of officers and men to provide needful supplies and professional care to the sick of camps and the wounded of battle. The training should be effected in times of peace, and the methods should be those that are to be used in times of war. Now the regimental system is incompetent on modern battle-fields. It is claimed sometimes, indeed, that the excellent working of our Medical Department during the War of the Rebellion was effected under this system; but the claim should be rather that it was effected in spite of it. Our field division hospitals were organized by treating regimental medical officers as staff officers subject to the orders of medical directors, and irrespective of State or of regimental numbers; and the importance of the work done in them detached their personnel as completely from their regiments as if they had belonged to a special corps. In fact the medical work of the war of the Rebellion, which at first under the regimental methods was such as to cry aloud to the country for help and to bring into existence the Sanitary and Christian Commissions and many State aid societies, became after the organization of the field hospitals a very model for the armies of the civilized world. To effect their organization the medical and hospital systems now in use by the National Guard of most of our States, and then in use in the Army, had to be broken up in favor of a medical staff with a special corps of hospital and ambulance men such as the Army now possesses, and such as Army medical officers now urge upon State military authorities.

Such a similarity of organization is hoped for by Army medical officers in the not distant future, that they may have as full an assurance of prompt and efficient assistance in the work of caring for the sick and wounded as is already felt by the Army generally concerning the loyal support that would be brought to the National Standard by the well drilled battalions from our various States.

OBSERVATIONS ON THE PHYSICAL EXAMINATION OF THE RECRUIT.

By Frank R. Keefer,

First Lieutenant and Assistant Surgeon United States Army.

Sickness, vastly more than injuries received in battle, is the cause of martial inefficiency. This fact has been noted by all commanders since the beginning of history. It is therefore of the highest importance to the power of an army, that all weak, disabled men, and those who possess defects which in active service would, in all probability, quickly place them *hors de combat*, should be excluded from the ranks

of the fighting force. Reports of officers prominent in wars of the last century are all to the effect that great numbers of men die or become incapacitated for service because insufficient care is used in the selection of recruits. A knowledge of the causes, especially the *predisposing* causes, determining sickness must, therefore, it is clearly evident, be had by examining officers.

To add more force to the preceding remarks, it may be stated that only one-third to one-fifth the deaths which occur in a war are the result of wounds received in battle; the rest are due to disease. Moreover, as is well known, the number of pensions issued for disease contracted in war is much greater than that for injuries. Not only is an army rendered ineffective by poor physical quality in its recrui s, but the cost of conducting its operations is vastly increased. Farr, an English military surgeon and statistician has said: "Nothing is so expensive as an unhealthy military force." How vastly important, then, is it to the efficiency of an army that, first, its examiners of recruits shall be thoroughly competent; and second, that all unhealthy individuals shall by them be excluded.

The examining surgeon has manifold and complex obligations. It is his duty to the State to hold all to service who are physically fit; to the army for which he is recruiting, to exclude all diseased or in anywise disabled individuals; this also, out of justice to the man undergoing examination; and for the sake of the man's future associates in the army, the examiner should reject all those who have such diseases as are readily communicable—for example, acute gonorrhœa, pediculosis—or, if the need be urgent, retain them under treatment until such time when the danger of spreading the affection shall have passed.

The army of the United States is recruited by voluntary enlistment during peace, while in case of war, forced draft is employed to fill the ranks. The need of men being so much more urgent underthe conditions of war than under those of peace, it follows that the methods of examining officers shall differ somewhat in the two cases. In thefirst many mild diseases and slight disabilities which should exclude under place, a system of voluntary enlistment, when the material is ample, should not exempt when much greater numbers of men are demanded. Among such defects are: Hemorrhoids, hydrocele and varicocele (unless excessive), harelip, total loss or general caries of teeth, deafness in one ear, splayfoot, alopecia, hammertoe, clavus, skin disease (unless very unsightly or debilitating), hernia (if controllable by

truss). Those subject to such affections may be made useful in the various staff departments.

Then again, while the volunteer—who is desirous of enlisting—seeks to conceal an existing defect, on the other hand a conscript, who in the great majority of cases desires nothing so ardently as to escape the perils of war, is only too apt to feign some disability which would exempt him, or to magnify a slight but not disqualifying defect, to the same end. The disabilities most often concealed are:—venereal diseases, chronic rheumatism, epilepsy, limitation of articular motion, intemperance and defective sight and hearing. Those most commonly feigned are:—defects of vision and audition, chronic rheumatism, epilepsy, anchylosis or stiffness of a joint, aphonia and chronic ulcers.

In examining recruits, hard and fast rules should not be followed, but the examiner should be permitted and expected to exercise his judgment. When conscription is being employed the surgeon, if he suspects malingering, should have the authority to send the man to hospital for observation or experiment, to use instruments and anæsthetics, or even to place the suspect in confinement in the endeavor to form a proper idea of his true condition. The State has the indubitable right to hold a healthy man to service and honest men would object the least to the above procedures. Laws should be enacted, as in certain European States, imposing severe punishment on men who mutilate themselves to avoid conscription and on surgeons who aid them therein.

The affections most often necessitating rejection are:—organic diseases of the heart, lungs, eyes, circulatory and digestive systems, hernia, local injuries, defects of locomotion and venereal diseases (notably, of course, syphilis). The examination should be held in a well-lighted room at least twenty-five feet long, which should contain as its furniture, a desk, a cot, platform scales and measuring rod. The examiner should have as equipment, a measuring tape, stethoscope, Snellen's 20-foot vision test types, skeins of wool for determining color perception and materials for vaccination; very rarely it may be necessary to make an urinalysis or urethral exploration, so appliances for such purposes might well be included, to make the armamentarium complete. Should forced draft prevail, when malingering is common, anæsthetics should be at hand ae well as an ophthalmoscope, colored glasses and a prism, for detecting fraud in alleged defective vision. It is important, although not absolutely necessary, that an intelligent assistant, preferably a

non-commissioned officer of the regular service, be present, who shall be thoroughly instructed in the various movements which it is desired the recruit shall perform; the latter will imitate the assistant as nearly as possible, while the examiner is enabled to give his entire attention to the observation of the man. The recruit should, before presenting himself, have had a bath; this for several reasons, chief among which is that many defects may be concealed by dirt; moreover, he is rendered less offensive to the senses of the examiner. A well defined system should always be followed so that nothing may be forgotten or omitted, as would almost inevitably be the case if this were not done.

First, a series of questions, such as that now in use in the United States Army, which aims to bring out the physical, mental and moral attributes of the recruit in his replies, should be asked.

Misrepresentation as to age is frequent and is often made by boys who are desirous of donning a uniform. In this connection it should be remembered that young men have a physiological susceptibility to disease; this is heightened by change of climate, so, for foreign service, or service remote from their homes, individuals of a more advanced age should be selected.

The present age requirement for the United States army is too low; boys of 16 to 18 are accepted and their soft and immature tissues and undeveloped organs yield in a very large proportion of cases to disease when called upon for active duty. Twenty years should be the very limit and youths of that age should be accepted only when fully developed and presenting all the evidences of maturity.

The sight and hearing should now be tested; it is recommended by some to defer this till after the examination shall have been otherwise concluded, but I have found it in many cases a waste of time and patience to go through a long examination only to find that the man has some disqualifying condition of one or the other sense.

The sense of hearing should be tested by closing the meatus auditorius externus of one side with the tragus or lobe of the ear, preferably the lobe, as it will in the majority of cases more thoroughly occlude the opening. This, that it may be properly performed, should be done by the surgeon. The assistant, standing from twenty to forty feet distant, will, in a low conversational tone read a few words which will be repeated by the recruit, who stands with his back to the reader, that he may not see the motion of the latter's lips. If a more delicate test be deemed necessary, a watch or tuning-fork may be employed in the usual manner. These should be used if malingering be suspected, in alleged deafness.

For testing vision, the 20-foot types of Snellen should be used and lines should be marked on the floor to indicate various distances. The card on which the types are printed is placed on the wall at a proper elevation where a good light falls upon it and the recruit, one of whose eyes is covered by some flat opaque object, is required to read or describe the letters or characters one by one. In the United States the vision of recruits, save those for the hospital corps, must be practically normal, but in some other countries certain degrees of myopia, hypermetropia and astigmatism are permitted. For example, in the French army, myopia over one-sixth, hypermetropia and astigmatism each to one-fourth do not exempt men having such defects. In Denmark men having only one-fifth of normal vision are accepted. But normal eyesight is becoming more and more important in the individuals constituting a fighting force, as finer rifle sights and longer ranges obtain. Still, men having defective vision, fairly correctible by glasses, may be fit for service in some staff corps. Should a conscript allege defective vision, simulation should be looked for and tests applied. Alleged blindness of one eye may be detected by the use of a prism, which causes diplopia if both eyes possess vision. Or, cause the suspect to read the Snellen colored types, green or red glass being placed before the sound (?) eye; complementary colors are thus made to fade or wholly disappear; if he states he can read the red types through the green glass, or vice versa, it is evident that he is using the eye alleged to be unsound. The recruit should now be required to remove his clothing; while doing this he should be narrowly watched by the examiner, for at this time he is apt to be off his guard, and a defect present which he is desirous to conceal may be detected, or the absence of a disability which he may subsequently feign noted. The height, weight and chest measurements are next taken. These, in a man fit for active service, should bear a certain relation to each other; this relation is well shown in the following table, which, with slight changes, is taken from "An Epitome of Tripler's Manual," etc., the recognized authority on the examination of recruits for the United States army:

Height.	Weight.	Chest Minimum.	Chest Mobility.
5 ft. 4 in. to 5 ft. 7 in..	2 lbs. per inch.	Half height + ½ in.	2 inches.
Above 5 ft. 7 in.....	2 lbs per inch; 5 lbs. additional for each inch over 5 ft. 7 in.	Half height or slightly less.	2½ inches.

Of course these rules are not absolute, a comparatively slight deviation in any particular being disregarded, so long as the thoracic viscera are healthy.

Nearly all nations have a minimum height at which recruits may be accepted; this minimum, as is proper, varies in different countries according to racial heights. France has the lowest minimum at 5 feet $\frac{2}{3}$ inch, England the highest at 5 feet 5 inches. When an army is small and has ample material from which to select its recruits a certain height may well be insisted upon, but in war, when brains, eyes and hands are demanded to direct the gun and pull the trigger, a lower figure should be taken, especially since, as is well known, a short stocky man is possessed of greater endurance than a very tall one.

The measurements of the chest, maximum and minimum, should be taken immediately below the nipples; the advantage of this is that the great pectoral muscles are not thereby included; we have therefore only the chest movements to deal with and not the muscular contraction and relaxation. Some inexperienced examiners allow bodily contortions during these measurements, which is also manifestly improper. Should the recruit be rejected for some defect noted in the examination prior to this stage, the height, weight and chest measurements, as well as the complexion and color of eyes, should nevertheless be noted for statistical purposes. The examiner should now carefully scrutinize the body surface for the detection of any obvious defects, such as skin disease, pediculosis, ulcers, tumors, varicose veins, spinal curvature. This being concluded, the various parts of the body should be examined in detail; the cranium is felt, the eyes, ears, nose, mouth and throat critically viewed. The heart and lungs are examined by the usual methods of inspection, palptation, percussion and auscultation, and the abdomen is gone over systematically. The presence or absence of venereal diseases, testicular abnormalities, hernia and hemorrhoids is next ascertained. Incomplete inguinal hernia is best detected by thrusting the index fingers through the external abdominal rings, well up into the inguinal canals, the recruit being directed to raise his arms above his head and to cough vigorously. The testicles must be *felt* in order to discover their condition; the anus is exposed by causing the man under examination to turn his back to the light, to bend well forward and to separate his buttocks widely with his hands. The recruit must now be put through a vigorous gymnastic exercise, which is designed to show the power of his muscles and the mobility of his articulations; in examining the limbs, begin with the extremities and work upward to

the body, testing each joint in its proper motions. While cardiac and respiratory action is still excited, by reason of the exercises just finished, again auscult the heart and lungs. Finally, the examination is concluded by testing the color perception, after which the accepted recruit is vaccinated.

Before closing my remarks on the direct examination, however, reference must be made to the admirable system of recording personal marks, introduced into the United States army by Deputy Surgeon General Greenleaf; without such reference no article treating of the examination of recruits would now be complete. By means of the cards bearing the outline of the human figure, front and rear, every mark which will serve to identify a deserter or prevent re-enlistment of those dishonorably discharged may be accurately described and located. It is important, to prevent application for pensions being made on improper grounds, that all defects found by the examiner, which, while not considered disqualifying, may so become afterwards, be fully described on the examination papers.

Men unfit for the requirements of active field service may yet be of value in the corps of administration, where they could be employed as clerks, prison guards, drivers, etc. Those now exempted in most armies for such conditions as defective vision, stuttering, baldness, loss of teeth or of certain fingers or toes, or absence of one eye might be of great service in replacing able-bodied men who could be transferred to the fighting force proper.

In war, when compulsory service obtains, an individual found incapacitated by reason of such defects as insufficient height, weight, chest measure or temporary disability of any sort, should not be finally dropped; another examination in a year or more—should hostilities continue—might show him to have reached the standard.

FORT STANTON, N. M., June 17, 1893.

Maj. Girard, as Chairman of the Committee on Nominations, submitted the following report:

"The delay in this report is not due to want of unanimity, but, after the conclusion of our labors, to discuss with the Committee on Laws, an equitable method of voting, preventing the possibility at any future time of packing any meeting and then for all time to insure a just representation of the views of the Association.

"The Committee have unanimously nominated for President, Colonel N. Senn, Surgeon-General of Illinois. In making this nomination the Committee is mindful of the successful work of Colonel Senn

in organizing and fostering this Association, and, now that it is on a permanent basis embracing all the Military Surgeons of the country, believe that it is just, prudent, and for the best interest of the Association that Colonel Senn continue in office."

President.—Nicholas Senn, Colonel and Surgeon-General Illinois National Guard, Chicago, Illinois.

Vice-President.—Bernard J. D. Irwin, Colonel and Assistant Surgeon-General United States Army, Chicago, Illinois.

Second Vice-President.—Louis W. Read, Colonel and Surgeon-General National Guard Pennsylvania, Norristown, Pennsylvania.

Secretary.—Eustathius Chancellor, Lieutenant-Colonel and Medical Director National Guard Missouri, St. Louis, Missouri.

Assistant Secretary.—Julian M. Cabell, Captain and Assistant Surgeon United States Army, Washington Barracks, Washington, D. C.

Treasurer.—Lawrence C. Carr, Major and Surgeon National Guard Ohio, Cincinnati, Ohio.

Chairman Committee of Arrangements for 1894.—George Henderson, Major and Surgeon-General District Columbia National Guard, Washington, D. C.

The Committee further recommend that this Association meet at Washington, D. C., on the first Tuesday in May, 1894.

ALFRED C. GIRARD,
Chairman.
ARTHUR R. JARRETT,
Secretary.

Adopted unanimously.

A recess was taken until 2 P. M.

E. Chancellor,
Secretary.

THIRD DAY.—AFTERNOON SESSION.

The session was resumed at 2 P. M. in the United States Government Building, Jackson Park, Chicago, Ills., President Senn in the chair.

The President announced that the subject of gunshot wounds was now open for discussion.

REMARKS BY CAPTAIN LAGARDE IN THE DISCUSSION ON THE SYMPOSIUM OF GUNSHOT INJURIES.

Projectiles fired from rifled hand weapons are given two motions, a motion of translation and one of rotation upon their long axes. The motion of translation for the projectiles of hard exterior belonging to the small bore rifles is 2000 f. s., and that of rotation is 2400 times per second; in other words, the velocity in transit is 60% greater with the new projectile as compared with the old, and the velocity of rotation is found to be 200% greater. We know that the velocity of translation gradually diminishes, because it has been computed by exact methods at all the ranges. What about the velocity of rotation, does that diminish *pari passu* with the velocity of translation? Upon this point I have never been able to obtain satisfactory information from ballisticians, and I am inclined to believe they know nothing definitely about it. Bruns says it does not. The destructive effects of the old and new armament upon resistant bones are greater in the near and remote ranges, whilst in the middle ranges the destructive effects are sensibly less. In the near ranges, the velocity and resistance on impact and deformation are ascribed as causes of the remarkable lesions found. But why should the projectiles again begin to shatter in the remote ranges? Some observers say that the velocity of rotation does not diminish perceptibly, and that the velocity of translation having been about expended when the projectile strikes resistant bone the velocity of rotation creates a great commotion, hence the increased shattering for the remote ranges.

Lieutenant William C. Wren, United States Army, believes that the projectile is given another motion in addition to that of rotation upon its own axis, and that is a circular motion. He likens it to the motion imparted to a top in spinning. At first the top rotates upon its long axis swaying from side to side, presently it is so steady in its rotary movement that it seems nearly motionless. As the velocity of rota-

tion diminishes the top again begins its swaying motion, and he believes that the destructive effects in the close and remote ranges may be attributed in part to the latteral pressure exerted by this swaying or wobbling motion, which he believes takes place with the projectile as it does with the top.

General Griffith, after commenting upon the extensive explosive effects, found in near shots on the abdominal viscera of live dogs, in which the animals died as promptly as though they had been electrocuted, speaks of the increased rotary motion of mantle projectiles as exerting a centrifugal force, the terrific effects of which have not been sufficiently appreciated by observers.

It is a fact that modern projectiles show strong explosive action in consequence of their increased velocity and their great length and weight in contrast to their caliber; besides which they are subject to deformation which adds to the ugly character of the wounds inflicted by them. Steinburg and Kocher have already sounded the note of warning against a too great reduction of caliber which entails greater weight and length of the projectile, and they assume 6.5 mm. to be the lowest admissible caliber; in addition the mantle should not deform on impact, and it should, therefore, be composed of a hard jacket like cupro-nickeled steel.

The subject of projectiles was further discussed by Major Girard, Major Niedman, Captain Woodruff and Colonel Irwin.

THE DIAGNOSIS TAG IN THE FIELD.

By Major V. Havard,

Surgeon, United States Army.

In the field, economy of time and of suffering to the wounded should be guiding principles. A wounded man, before reaching a permanent hospital, may pass through several lines of help and through the hands of perhaps half a dozen surgeons; must they all successively question and examine him to find out what is the matter, thus losing valuable time, subjecting him to useless pain and his wound to unnecessary exposure and infection? Economy as well as common judgment clearly dictate that after being first examined, whether on the battlefield or at the dressing station, he should carry with him, in an ostensible manner, the result of this examination so far as it goes, and thus be spared all further unnecessary handling. This is accomplished by the diagnosis tag.

The diagnosis tag, conspicuously fastened to the clothing of the patient, shows at once that he has already received first aid; the brief entries written upon it give further information as to the identity of the patient, the nature of the disability and the treatment pursued. But these entries, probably written in a hurry, are perhaps not very legible; they may have been defaced by blood, rain or dirt; hence the necessity of using a tag that can give as much information as possible at a glance and independently of any writing upon it.

For this purpose, colors seem to be most useful. In the French, German, Italian and perhaps other European armies, two kinds of tags are prescribed, one white, the other red; the white tag denotes that a patient is so desperately wounded as not to be transportable; the red, that the patient can stand transportation; thus, a look at the tag gives an idea of the gravity of the injury and, to some extent, of what can be done with the patient.

An international diagnosis tag which would, in all places, have the same value and significance to both sides on the battle-field, is certainly a great desideratum and might be a proper subject for an additional article to the Geneva Convention.

According to the spirit of the Geneva Convention, which now binds all civilized nations, so soon as a soldier is struck and *hors de combat* he becomes neutralized and an object of solicitude to friend and foe; therefore the necessity to remove him to avoid capture by the enemy is not urgent and need not always be an important consideration, provided, of course, all possible efforts are made to shelter him from further harm. Thus, of the many wounded brought to the collecting or first dressing station, a certain proportion will be exsanguinous, unconscious, suffering from extensive injury of the brain substance, spinal cord or abdominal contents, from fracture of the pelvis with comminution and shattering, or from multiple severe injuries. To move such patients is to condemn them to certain death; they must be treated in loco whatever the issue of the battle may be. Under Article 4 of the Geneva Convention, the personnel and material of the dressing and ambulance stations are exempt from the laws of war and not subject to capture; they may return to the command to which they belong at any proper time after an engagement.

From this it follows that one of the first things to determine by the surgeon on the line of battle or at the dressing station is whether the patient should, or not, be carried any further to the rear, and having formed his conclusion he labels him accordingly with the diagnosis tag so that all may see the result of this primary examination. Such

discrimination between transportable and non-transportable patients is advantageous not only to the latter but also to the former who have thus more available vehicles for their removal.

I have here a book of the tags prescribed for the Medical Department of our Army. As you may see, they are made of white paper partly reinforced by linen and bearing several printed heads for the necessary entries. On corresponding stubs the same entries are written so as to make duplicates and enable each surgeon to preserve a record of his work. In the lower corner, and through the reinforced part of each tag is a slit by means of which it is slipped over a button of the patient. This tag is obviously defective; I presume it is merely suggestive and provisional, to be used only until all the requirements of a perfect tag have been elucidated.

What are these requirements, so far as it is now possible to formulate them?

In the first place, simplicity demands that it should be one and the same for all cases; that is, different kind of tags should not be used for different wounds. The white and red tags of European armies are therefore objectionable as requiring a double supply and tending to delay and confusion.

When we consider that, in a battle of any magnitude, thousands of tags will be used, the necessity appears to have them of thin material, so that a book of 40 (the least number that should be bound together) may not be inconveniently bulky. The material, although thin, should, of course, be strong and, if possible, impervious to rain. The French tag is made of cardboard, the German of ordinary baggage tag paper. The material in both is too thick and would not stand much exposure. Thin parchment paper might answer the purpose.

Now, how should the tag be fastened to the patient? The slit, such as in our tag, is not satisfactory; it is somewhat difficult to pass it over a button, and the tag is often torn in the effort. Besides, the patient may not have his blouse on; he has lost it, thrown it away, or it has been removed for purposes of examination and treatment, and there is no brass button in sight to hang the tag on. In my opinion the quickest and most efficient way is by means of the common paper fastener. Whenever the surgeon puts a book of tags in his pocket he drops in the same pocket a corresponding number of fasteners, and he is thus enabled to secure his tags to all patients under all conditions and always at the same spot, over the sternum.

The entries should be simple and only such as are absolutely necessary, viz.: Name, rank, regiment, injury or disease, treatment, signa-

ture of surgeon. Each French and German soldier in the field wears, fastened to a tape passed around his neck, an identification plate or medallion on which are engraved his name, number and residence, so that the entry of these on the diagnosis tag is surperfluous. I judge that with us such a system of numbering men will always be impracticable and that the identification must be established on the tag. Should the surgeon be under stress of time owing to the accumulation of patients upon his hands, he may simply jot down the diagnosis and treatment, leaving the name and regiment to be filled in at some more favorable time and place.

The plain white tag is useful, but, as already implied, does not fully answer its purpose; the mere appearance of the tag should convey prompt information independently of the writing upon it—enough information, in fact, to make it valuable in the absence of all writing. To this end colors are used, and I here submit a model (on ordinary paper) of the tag which I have devised as, in my judgment, embodying in the simplest manner about all that a tag can do:

TRANSPORTABLE. (Perforated Line.)

Date _____

Name _____

Rank, Regiment _____

Diagnosis _____

Treatment _____

Urgent _____

Ambulance Station _____

Signature _____

(Perforated Line.) NOT TRANSPORTABLE.

My tag, then, consists of a white body and two colored borders; on the body are the printed headings of the entries to be made; the borders are separated from the body by a perforated line so as to admit of being very easily torn off; the left border is red and the right blue; on the red is printed "transportable," and on the blue "not transportable." Now, let us imagine ourselves at the dressing station; a patient's wounds have been dressed so far as circumstances allow; hemorrhage has been checked or a fracture provisionally set; as the last act of "first aid" the tag is prepared and fastened on.

In case of a simple flesh wound, whether the patient is or is not able to walk, both colored borders are torn off leaving only the white body of the tag; if a man is severely wounded, unable to walk but able to be transported, the blue border is torn off, leaving the red; if

a man is desperately wounded and can not be moved without extreme danger to life, the red border is torn off, leaving the blue.

We have here, therefore, a plain, though composite, tag which indicates at a glance, and independently of any writing, the severity of the injury and the proper disposition to make of the patient. The officer or steward in charge of the ambulance transportation need only look at a patient's tag to know whether to take him in or let him alone, any ambulance or wagon driver on his way to the rear can thus ascertain which of the wounded and stragglers crowding the road deserve preferably his recognition and assistance.

You notice that three lines are provided on the tag for treatment; the first two are to be filled in by the surgeon preparing the tag, the third by the surgeon at the ambulance station and records any additional treatment applied there. The surgeon who first examines a patient naturally ascertains what immediate treatment is needed and he applies it so far as he can; but his facilities are quite limited by lack of time and material; it is therefore necessary he should state on the tag, not only what he has done but his judgment of what is further urgently required, if anything; hence the line on the tag under "treatment" and headed "urgent;" for instance, he may only be able to apply a tourniquet to check a severe hemorrhage; then under "urgent" he will write " ligature to (such) artery;" if there is no immediate dressing or operative interference required, the "urgent" line is left blank and the ambulance surgeon, if hard pressed, may forward patients whose tags have this line blank directly to the field or permanent hospital.

How may we convey to the medical officers of the enemy, who possibly do not understand our language and into whose hands our wounded may fall, the important information on the "urgent" line? This is readily accomplished to a certain extent by the use of figures; thus 1, preceding the entry, means that dressing only is necessary; 2, that an operation is required, while a blank, as before stated, means that the patient needs no immediate attention.

The stub appears to me entirely superfluous; it is hard enough for the surgeon to fill out a tag for each patient on the battle-field without requiring him to duplicate the work. All the wounded will eventually find their way, or be brought, from the front to the ambulance station and if, at this place, the contents of the tags, together with all needful details, are entered on a special register, we have a sufficient verification.

At the ambulance station all patients who have been dressed and operated form three classes:

First. The slightly wounded, many of whom, after a rest and the use of restoratives, may be able to walk to the field hospital.

Second. The severely wounded who can not or should not walk but can stand transportation in ambulances or other vehicles.

Third. The desperately wounded who can not be moved any further without danger to life.

In all, the diagnosis tag is verified and completed or a new one put on. The patients of the first class wear the plain tag; those of the second class the red-bordered tag; those of the third class the blue-bordered tag.

As patients arrive at the field or permanent hospital the tags secure for them prompt admission and distribution to the proper wards without further investigation and delay. Even here the useful career of the diagnosis tag is not ended, for it is fastened to the patient's pillow or bedding and becomes, for the time being, his hospital ticket.

The diagnosis tag was discussed by Lieutenant Ohmann-Dumesnil, who made the suggestion of folding the tag at each end, as the case might indicate, instead of tearing off or perforating.

The subject was further discussed by Major Girard, Colonel Senn and Major Niedman.

THE PREVENTION OF CUTANEOUS PARASITIC DISEASES IN SOLDIERS.

By A. H. Ohmann-Dumesnil,

Lieutenant and Assistant Surgeon, National Guard Missouri.

Military surgery has for its primal object not alone the proper care and treatment of sick and wounded soldiers, but the prevention as well of those conditions which will or may contribute to their greater or less inefficiency. Every cause which tends to disable, in ever so small a manner, a soldier so far as his physical condition is concerned, is a matter deserving of more than passing attention at the hands of the military surgeon. In no condition, nor under any other circumstance, is the full truth of the old saying that "an ounce of prevention is worth a pound of cure" more thoroughly applicable. The efficiency of the soldier is in direct ratio to his health, and vice versa,

and every condition which interferes with this ideal state is one which renders him less useful and consequently less effective. Not only this, but if he be disabled through any means, he is not only useless as a destroying factor, but he becomes an additional charge and source of expense and, from a purely utilitarian point of view, is inferior to one who has succumbed in battle. This is probably the reason why modern warfare has had for an object not so much the killing of soldiers as disabling them, in the hope that the additional burden in caring for the wounded would more effectually cripple the enemy than an actual loss of life in its ranks.

The subject I have chosen is not one generally taken into consideration, in view of the graver forms of conditions which are met with by surgeons. The major surgical operations, the extensive traumatic lesions observed in warfare, and the ravages of camp epidemics of a grave nature appear so important as to cause the consideration of cutaneous parasitic affections to dwindle into insignificance almost. Yet this is a mistaken idea, and one which should receive more attention, because a certain amount of importance attaches to these diseases and, in a military sense, it is much greater than in civil life. My hearers are no doubt aware of the fact that, up to comparatively late years, favus was considered sufficient to exempt any one from military service in Italy, so much importance was there attached to this parasitic cutaneous trouble and its baneful results. But this state of affairs did not continue, and the striking off of the disease from the list exempting conscripts caused a rapid diminution in the number of cases observed by examining surgeons. The fact remains, however, that the trouble was looked upon as more than ordinarily serious for quite a number of years.

The best soldier is he who is always ready for active service and who is not a burden upon the country. Everything which detracts from his ease and comfort is to be regarded as crippling his capacity to the extent to which he is inconvenienced. It is not only the physical want of ease which is observed under these conditions, but a want of moral tone supervenes upon being infested with parasitic skin disease. Furthermore, the soldier becomes a focus of infection and is very apt to be looked upon with distrust or disfavor by his companions in arms, or even be avoided by them or subjected to petty annoyances of such a character as will either make him still more careless or lead him to actual desertion. A little care and attention would obviate all this.

To be more explicit: It is well known that all parasitic diseases of the skin are attended with itching of a more or less marked character, but always extremely annoying. This pruritus has one very bad effect, in that it robs the soldier of needed rest. Sleep can never be satisfactory under such conditions, and instead of having a bright, alert man at reveillé, we are presented with a sleepy, worn-out, listless individual, who has a demoralizing effect upon the others. He may be punished for this, and will secretly resent it as a wrong done him; or, the matter may be left unpunished and an incentive furnished to others to be neglectful of their duties. Besides loss of rest, the efforts at scratching indulged in by the afflicted soldier will lead to more or less severe excoriations, and these in turn will induce neglect of the person and, in a very short time, a filthy condition of the body and clothing of the soldier will be the inevitable result.

This is no exaggerated picture, as the testimony of those who were active participants in our Civil War will show. The excoriations mentioned above, especially when accompanied by want of personal cleanliness, will easily lead to graver troubles in many. They form the ready avenues of infection and render those afflicted with them much more susceptible to systemic disturbances by reason of the exposed cutaneous tissue which readily absorbs any infectious material which may be floating about, as well as to any sudden change in climatic conditions. I do not desire to enlarge upon the importance of preventing such a condition as the parasitic invasion of the skin in soldiers, for a little reflection on the subject will readily show the many points having a direct bearing upon the welfare and, consequently, efficiency of the soldier. Nor will I touch upon the treatment of such cases, the prophylaxis being really the important point at issue, and this being attained there will be but few cases that will ever need the application of curative measures.

To begin with, the recruit should take a full bath and after this a careful inspection of his body made. His hair should be cropped close and always kept so. His clothing should be changed as often as is compatible with circumstances, and should not only be washed but subsequently subjected to dry heat, so as to thoroughly sterilize it. Such an operation can easily be carried out and will insure thorough cleanliness. A bath should be taken at least once a week, and upon each occasion the surgeon should inspect the soldier before he is permitted to assume his clean clothing. After the bath a light sponging of the entire body, scalp and face should be made with some antiseptic. A very good fluid, which is efficient and painless, is one com-

posed of sixteen parts of water to one part of deodorized chlorophenique. Under no excuse should soldiers be permitted to escape the bath, disinfection and subsequent inspection. This can be very easily accomplished in barracks and entails but little inconveniences in camp. One sheet-iron box is sufficient to heat the clothing of a regiment, and can be made to fold up so as to render it easily portable. An added advantage to the system is that infected cases can be treated immediately and segregated, thus removing to a distance a focus of infection. Another advantage lies in the fact that other cutaneous troubles are thus easily discovered and venereal diseases may be found in their incipiency, thus affording material aid in lessening the periods of treatment.

An observance of some such method would practically free a body of soldiers of filth, vermin and parasitic disorders, and, at the same time, contribute to making them more alert, attentive to thetr duties, more efficient and cheerful, and correspondingly better disciplined and better satisfied.

MILITARY MEDICAL PROBLEMS.

By Chas. E. Woodruff,

Captain and Assistant Surgeon United States Army.

An experience of several years of military medical practice in time of peace and the conversations of military officers have suggested numerous medical problems relating to soldiers. As a general rule these are new and have had no solutions suggested, unless it be among reports carefully stowed away in some office no one knows where or how to get at them. Perhaps an enumeration of these questions may bring out good practical answers from others of more experience and knowledge. This paper can not, therefore, be considered as adding much to the science of military medicine, but is rather in the nature of an individual confession of ignorance and a request for light from others.

PECULIARITIES OF THE PRACTICE OF MEDICINE AND SURGERY AMONG SOLDIERS.

Let us first take up the conditions which make military practice so different from civil practice. In civil life medical attendance is a voluntary service on the part of the surgeon, and its reception is equally voluntary on the part of the patient. Dissatisfaction on either side re-

sults in cessation of treatment. All this is much different in the case of military surgeons, whose duties are official and compulsory. The soldier is compelled to submit to the professional treatment of the authorized surgeon, and refusal to take the prescribed treatment or to submit to the necessary surgical operations is proper cause for trial and punishment by court-martial. To permit or overlook such conduct would soon result in demoralization in times of danger, for the soldiers would make themselves sick and keep themselves sick to escape duty, and the line would be depleted of fighters. Under such circumstances it is always necessary to compel soldiers to get well, for it is not practicable to depend upon patriotism to keep men's faces to danger. In the presence of imminent death patriotism is apt to vanish, and the soldier, no matter how brave, is liable to become panic-stricken and be actuated by a desire to seek safety by any means at his command.

In times of peace it is the rule to make matters of discipline come as nearly as possible to the conditions of war, but it is a question whether there is any justification for allowing matters of medical treatment to be so managed. In the first place, it is found by experience that soldiers readily submit to all reasonable restrictions and methods of treatment, and many unreasonable ones, too, for that matter. Most surgeons submit to the patient the matter of any operation, no matter how trivial, and get his consent. If reluctance is shown the matter is temporarily dropped, and it is quite rare to have the interests of the service or military discipline in the least compromised. It is but seldom that soldiers absolutely refuse certain operations, and in those cases it is far better to secure their discharge, care being taken to state clearly and fully all the facts of the case, to prevent future frauds on the Government in the way of pensions.

In the second place, it is difficult, without making the matter ridiculous, to formulate charges against soldiers for refusing to submit to medical treatment. Such charges always appear small and trivial, and at first glance are apt to provoke a smile. The daily papers report the matter with a headline such as "Court-martialed for refusing to take a pill." The dignity which supports discipline can not be destroyed more quickly than by ridicule. In times of peace, therefore, it is a question if it is not proper in professional matters to make the relation of surgeon and soldier as nearly as possible the same as in civil practice. The avoidance of all controversy and of any appearance of compulsion, and the omission of charges for court-martial should be the guiding principle. Surgeons who rely upon other principles, and depend upon the powers of rank to carry out their methods

of treatment, are apt to be shunned and considered somewhat brutal, and their influence is apt to be for the worse. They do not advance the interests of military medicine. When the rare cases do arise in which the above methods are not applicable, it is easy to make a change of tactics to compel the soldier to get well, so that the professional reputation of the surgeon will not be compromised.

MALINGERING.

This brings up the great question of malingering, which is such an every-day affair in the life of military surgeons. It is so common among soldiers that military surgeons of twenty years' service are markedly affected by it in their relation to the sick. It is a rare occurrence for an old military surgeon to listen to the symptoms of a soldier without thinking of the possibility of there being partial or complete simulation. All this comes from the fact that it is usually to the material interest of the soldier or his relatives to have facts as to his physical condition concealed from the authorities. It is true from the moment he thinks of enlisting until long after his death and the death of dependent relatives who might demand pensions. In applying for enlistment he knows that defects mean rejection, so that if there is or is not anything to conceal there begins a series of astonishing prevarications. On account of this a rule has been evolved in enlistments as follows: "If in doubt, reject." After enlistment the soldier's tactics are usually reversed, and instead of concealing defects he may simulate disease to escape irksome duty or to obtain discharge and pension. During the conscription, also, men will simulate disease, cause deformities to appear and prevaricate as to their general health and do all they can to prevent enrollment in the draft.

An almost daily experience with cases that raise a doubt as to the patient's veracity has forcibly brought to mind the great problem of how to make a diagnosis upon objective symptoms alone. Too often does it happen that every symptom depending upon the patient's statements and actions has to be discarded and reliance placed upon objective signs alone. Take at random any disease described in the books, scratch out the subjective signs—that is, discard what the patient tells us—and see how difficult it will be to form a diagnosis in the beginning of the illness. Of course, after a disease has progressed a certain extent, the objective signs alone are depended upon, and, indeed, then the patient has little or no cause to avoid the truth. Complaint is made of the meagreness of the literature of this subject;

the books contain nothing, because it little concerns the mass of civil practitioners, who are never on the look-out for malingerers in their offices. For instance, a few years ago a peculiar woman correspondent of a daily newspaper visited the offices of some of the most prominent physicians of a city. She feigned a sickness, and gave each physician an account of her symptoms, which were purely subjective, and probably different in some manner or other in each case. She then wrote up her experiences, giving the different diagnoses and methods of treatment. It is not to be wondered that the doctors disagreed—it would be peculiar if they did not. Of course, it is impossible to make out a diagnosis where no disease exists. You can not get blood from a stone, but the above incident is mentioned to show the difficulty of detecting a malingerer on subjective evidence, particularly when it is not reasonable to expect malingering. It is not often remembered that the military surgeon may have such cases every day of his life.

It is not to be expected, therefore, in military practice to make an immediate diagnosis in many cases. Time is always taken to come to a conclusion or to allow the soldier to compromise himself by some little act of forgetfulness, and the number of cases "awaiting diagnosis" must always be larger than in civil life. To jump at a diagnosis too often means a subsequent change of opinion.

Pain is the soldier's stand-by and good friend in time of need, for nothing is harder to detect than the simulation of slight pains that prevent the performance of duty, and they constitute the majority of the cases of supposed malingering. We do not know what the white soldier would do without his pains, nor the colored soldier without his "miseries."

What makes this whole matter of malingering more trying in times of peace is the necessity for excusing soldiers from duty for ailments that a civilian would not notice. A man very rarely stops work for a "stiff neck" or a painful shoulder due to a bruise, yet a soldier with these trifles is entirely out of place in ranks. He can not perform the manual of arms, and if he is forced to go to duty he drills so badly that he may be subjected to a trial by court and then the surgeon is always dragged into the case to give expert opinions. In time of war men are prevented in another way from applying to be excused from duty for slight ailments. There is the fear of being considered a coward or of receiving the jibes and jeers of his comrades who consider him unmanly.

Affecting the methods of diagnosis, there is another characteristic of soldiers which is far different from malingering though quite apt to be confounded with it. In civil life a man goes to his daily work in spite of manifest disability because he knows his bread depends upon his labor. It is quite remarkable under what great disabilities a man will work cheerfully and willingly. In military life it is not so, for a man's pay goes on whether he is sick or not, yet the soldier recognizes the necessity of making his illness clear to the proper authority before he can be excused. He is quite apt, therefore, to overstep the mark a little bit in his anxiety to make it clear that he is ill. He is liable to labor under the feeling that he may be compelled to work, when he would stay at home if he were his own master. The military surgeon here again must depend on subjective symptoms, for he is liable to make a diagnosis of serious illness, or be convinced that diseases have more marked symptoms than in civil life.

No doubt it would be of immense benefit to publish accurate accounts of every known case of malingering with the methods used in detecting the fraud. These cases are so rare in civil life that when a marked case does occur, it is apt to find its way into current literature. The numerous cases occurring in military life are rarely brought to light because they are but of a passing interest to the great bulk of the profession. The Surgeon General of the army requires detailed reports of all cases of malingering because they are of such vital importance to the military surgeon. It is to be hoped that the current literature fostered by this Association will contain all available cases, for only by such means may detection of future cases be made easy. At the present time the poverty of the literature of this immense military problem causes each young surgeon to devise his own methods to each particular case, often at the expense of efficiency and valuable time.

THE PROPER PLACE OF THE MEDICAL DEPARTMENT.

In recent years much has been written about the proper place of the medical department in an army. You have all been full of this subject long ago and rehash of the matter may be odious. A mere glance at the history of medicine and surgery fully explains why the proper sphere of military surgery is not more fully recognized. It is too new, and it inherits the odium of its immediate predecessors, those horrible practices which make up the surgery of the middle ages. Until recently medicine had always been under a ban and to a slight extent it still is, for it is such a tempting field for charlatans.

Only recently a silly English newspaper tried to discuss whether a doctor could be a gentleman. In ancient times medicine and priestcraft went hand in hand; cures were more often attempted by faith in prayers than by faith in rational medicine. Doctors were usually slaves of rich men, and the intelligent physicians were so few that they now stand out as bright stars against a background of black ignorance. After the downfall of the Roman Empire the remnants of medical knowledge were preserved by the Christian church, but as all useful knowledge was in time affected by the surrounding ignorance, medicine itself was prostituted to the most wretched practices. Pope after Pope tried to separate the monks from their horrible work, and the fight against the practices was finally turned into bitter denunciations of medicine itself, for "In 1215 Innocent III. fulminated an anathema specially directed against surgery, by ordering that, as the church abhorred all cruel and sanguinary practices, no priest should be permitted to follow surgery, or to perform any operations in which either instruments of steel or fire were employed; and that they should refuse their benediction to all those who professed and pursued it." The Christian armies of that day could not have contained any proficient military surgeons, and is it any wonder that the gentlemen of Europe whose sole occupation was war should exclude surgeons from their society. Military surgery was in a deplorable state for many centuries after this, and as late as the time of Henry VIII. the army was overrun with charlatans calling themselves surgeons, and they did so much harm that the commanding general, the Duke of Bedford, had to threaten to hang them unless they declared in truth what they were, and it was truly found that they were "sow gelders, horse gelders, tinkers and cobblers." Thomas Gale who records the above, subsequently became sergeant-surgeon to Queen Elizabeth, and if the names of rank are approximately correct, he was not a very high official.

Before and after this time the great mass of surgeons were barbers, and it was only occasionally that such names as Ambroise Paré shone out of the darkness. Evidently, then, we can not expect that military surgery should have occupied any position of importance for a long time, and though the 17th century seems to show some regard for the surgeon, it is not until the 18th century that we see him recognized as an important adjunct of every army. Napoleon's high regard for his chief surgeon, Larrey, is well known to us all.

Throughout all this time the surgeon was rather looked down upon in general, though looked up to in particular if he was conservative

and educated. Nothing can equal the regard and personal affection the soldiers of all times, both ancient and modern, have shown for the efficient army surgeon who relieved their sufferings in times of war. In other words, as a man he was liked—as an officer he was despised. The change from this state of affairs began only recently, and it has been going on so slowly and steadily that officers now in the service do not know of it. Many still look upon the surgeon as one whose only duty is to heal the sick. Only recently an officer wrote an article hinging on this one point, and his ignorance is shared by many others. It is not known that within the last 50 years the advances of medical and sanitary sciences has thrust upon the surgeon the most important work of preventing sickness. In his particular sphere he becomes the adviser of the commanding-general. He is expected to prevent the sickness that has so often depleted armies and led to defeat. He is expected to keep the fighters ready for fighting, and by those who seem to know all about it he is expected to do more than this; he is expected to do his duties without the authority to do them.

Even the hospital, about which as a center all military matters are grouped, is a very modern institution. There were none at all during ancient times except, perhaps, a few temples of Esculapius. In the dark ages the monks had a few badly-managed institutions for the care, or rather the neglect, of the sick, but it was not until the reformation that actual hospitals existed, and it was not for two centuries longer that hospitals devoted to the sole use of the sick were built. Though they were managed in some approach to modern methods, they were so horribly unhealthy that to be sent to a hospital was often to seal one's death warrant.

Military hospitals were probably not so backward, because battles demanded that some provision be made for the wounded. Though the Roman generals reserved some chariots to be used as ambulances to carry the wounded from the battle-field to adjacent towns, to be cared for, there were probably no military hospitals in the sense we now use the term. It is stated that in the crusades we find the first definite arrangements made for military hospitals. Yet the idea was of very slow growth, for it is somewhere stated that several hundred years afterwards—that is, as late as the 15th and 16th centuries—it was quite common to butcher the wounded soldiers or throw them alive into ditches rather than be bothered with the care and trouble of curing them. It can be quite safely stated that it was not until the 18th century that the military hospital became a recognized institution, and it

is this century that has given immortal military surgeons to the world, for here we find such names as Piragoff and Larrey.

Now, in view of the above history, is it any wonder that an institution several thousand years old should be backward in recognizing the claims of a youngster but one hundred years old? What assists in making this recognition so difficult is the conservatism inherent in military institutions. An army is an actual hotbed of conservatisms. Armies are always managed by older men of much experience, and such men are always apt to be guided by precedents and the results of past experience. New things are adopted begrudgingly and with some doubts of their usefulness.

I can suggest only one solution of this great problem as to the place of the medical department, and that is to do all we can to have it thoroughly and universally understood that military surgery is a distinct being, newly born and heretofore unable to speak for itself; that it consists as much in the knowledge of how to prevent camp diseases as how to cure them; that a military training and military bearing and military authority in his own department are essential to success, for without them no orders can be carried into effect. These things acknowledged, the importance of the medical department is acknowledged, and it will finally be recognized that a civil practitioner can not become an efficient military surgeon without giving much time and study to the special branches—useless for his civil practice, but indispensable in the army. A military surgeon who believes he is appointed for the sole purpose of extracting bullets and prescribing pills is a hundred years behind the times, and is as useless to an army as the soldier who believes he enlists for the sole purpose of wearing brass clothes and a tin hat.

Much might be accomplished by inculcating the idea that what is highly military to-day will not be military in twenty years, and things unheard of now will be common in the next generation. A short time ago a military doctor was supposed to be out of place; in a short time to come the army doctor who is not military will be dismissed for incompetence. A military officer who is not a military officer, is an absurdity.

SURGICAL TREATMENT IN THE FIELD.

The list of papers to be read fails to show that another great problem of military surgery is to be treated as a special topic, though it may be mentioned as a side issue. What is to be done for a particular injury near the line of battle has always been a puzzling

thought, and what is to be done for serious injuries by the operator in the field hospital is still more puzzling. A moment's consideration will show that the rules of the military surgeons of the last great civilized wars are now so out of date as to be unreliable, and there is little available knowledge in medical literature. The first factor that has so greatly changed military practice is the rise of the antiseptic and aseptic methods of wound treatment. In the last great civilized wars asepsis was an unknown element of practice, and the rules built up in ignorance of it must be totally disregarded. Witness, for instance, the practices during the rebellion of some field surgeons of hermetically sealing up the exit and entrance of penetrating wounds of the chest, a practice that was so disastrous that it had to be forbidden by order of the Surgeon-General.

The second factor is the immense change that has recently taken place in the treatment of certain surgical affections in civil practice. For instance, until recently it was considered bad practice to interfere with a depressed fracture of the skull if there were no symptoms of intracranial pressure or other cerebral involvement. The late Dr. Agnew, of Philadelphia, gave as one of his last contributions to surgery the rule that every depressed fracture of the skull must be operated on, whether there were symptoms of pressure on the brain or whether there were none. His views were generally concurred in by the surgeons who discussed his paper. In this class of injuries, as well as other classes, the field surgeons will find work to do that was formerly out of the question. Now, having given the rules of practice to be followed in civil hospitals, where we are surrounded by all the modern conveniences for surgical treatment, and where it is only a few steps from the operating table to the patient's bed, where he can remain until well, let us see what are the two great conditions that will make such marked changes in the rules for the treatment of the same cases in the field. First there is the great question of transportation. If the battle takes place but a few miles from a city, where large hospitals are ready to receive the wounded, there may be no change whatever from civil methods. From these circumstances there will be all gradations of distance to be traveled by the wounded before they can reach resting places for convalescence. There may be a wagon journey of ten miles and a railroad journey of 100 miles before a permanent hospital is reached. There may be a boat journey of 500 miles on an inland river. Finally, if the battle is fought in the interior of an enemy's country, there may be a rough journey of 100 miles or more to the coast, and a sea voyage of 1,000 miles or more

to the home hospital. Indian battles, fought on the frontiers, are apt to be far from good roads, and in that case we may have to prepare for a journey of fifty or 100 miles on travois or pack mules. Each one of these conditions will make some change in the character of the original operation and the subsequent treatment, and it seems almost impossible to formulate any rules in advance. Limbs may have to be sacrificed that would invariably be saved in civil practice, and wounds that we would always close up and expect to heal by primary union may have to be kept open and dressed every day en route.

The other great factor in military practice is the impossibility of getting strict asepsis in the field. Prof. Cheever, of Harvard, in some recent lectures, points out the fact that all modern surgical methods depend upon the constant presence of large quantities of pure water as the vehicle for antiseptics, and the impossibility of getting water in such large quantities in the field. The division or brigade field hospital is always placed near a good stream, where plenty of good water is available, and the difficulty of deficiency of water will arise only in exceptional cases, but when it does arise the state of affairs will be terrible. Drilled as we have been in the extreme necessity for the utmost cleanliness in all surgical matters, you can imagine our horror to find ourselves in the midst of a dozen or two operations with dirty, bloody hands and instruments, blood, vomited matter and other filth strewn upon the ground, and no water to clean up. It is to be hoped that such occasions will never arise; their bare possibility is only alluded to here. Some of the difficulty may be removed by instructing certain nurses to procure and preserve from contamination a very large supply of water in buckets, barrels and tubs; have large quantities boiled and thus rendered aseptic, and in all ways look out for the one item of water. It may be remarked, in passing, that it is no easy matter to get clean, boiled water on an ordinary camp fire, for the smoke will rise and dirt and soot be dropped in the water. Soldiers have often been seen making their coffee from water that was actually yellow with dirt from the fire. The men in charge of the matter will have special appliances for heating water.

There is another point, that has not heretofore been mentioned, and that is the danger from dust. Operations done in the open, and even in tents, will be vastly affected by dust if there should be a high wind. If the dust of the air is so dangerous in the minds of some surgeons as to lead them to construct special operating rooms, with arrangements for getting a dustless air, what can be expected from surgery in a tent with wind forty miles an hour? In the open air it

will be far worse. Recently I had to perform some simple surgical operations in the open air, and the wind suddenly arising before I was through, the dust made the antiseptic lotions look like mud. It is quite possible that in such cases some approach to asepsis might be made by the use of special closed receptacles for lotions. They will keep dust out of the fluids, but will not keep it out of the wounds. In the one class of gunshot wounds of the intestines, the matter of dust may make it criminal to follow the rules found best in civil hospitals, where perfect asepsis is possible. The matter of dust may fully explain the large percentage of cases of tetanus that follow some battles.

All the above refers to the division hospital which has been selected for its water. The surgeons near the line of battle or at the collecting or dressing stations will be far worse off, for these stations are selected for their proximity to the troops and not for their convenience to water. In these places aseptic surgery will be entirely out of the question.

As an illustration of these difficulties, take such an injury as a penetrative injury of the knee joint, keeping in mind the damage done by interference with dirty fingers or instruments. If the injury is not attended to at once the patient will do badly, for statistics show that if not treated for forty-eight hours something over 80, perhaps 90, per cent die. If it is treated it is apt to become a "fingered" wound and will of course do badly, perhaps be fatal. If it is closed up by some preliminary or first air dressing, it is virtually untreated, as it is nothing more than a culture ground for bacteria. We might dismiss the matter by saying that certain injuries that are apt to get well in civil practice are always fatal on the field of battle. Perhaps many of these cases can be saved by some system entirely different from those of past wars. In each campaign the surgeons may meet together and tabulate certain kinds of serious accidents, and strict rules will be formulated for each class of surgeons in the field. The surgeons on duty where asepsis is not possible will confine their efforts to stopping hemorrhage, relieving from collapse, putting on temporary splints. In all serious cases his duty will be to form a provisional diagnosis of the injury and by some provisional dressings protect from contamination by dirt. The more serious cases will be appropriately marked and will be given the right-of-way over all others to the operating surgeons. The first received will not be the first cared for, but all who can wait will be compelled to wait until all the cases are disposed of that are sent from the field. The surgeons at the relief stations

might be enabled to dress all slight flesh wounds aseptically by having closed vessels of antiseptic lotions brought to them by the ambulance and travois that return empty from the division hospitals.

The matter of the septic or aseptic condition of the wounds is also to be taken into consideration. If the campaign has been a long and severe one, the soldiers hard pressed and huddled together without bathing facilities or changes of clothing, they are quite apt to get into a horrible condition of filth and the presumption will be in favor of every wound being infected and apt to do badly. Conservative treatment or rather lack of treatment may be fatal, and an attempt at asepsis might be better than non-interference.

In case asepsis is impossible owing to the above-mentioned adverse conditions, the surgeon has another problem to solve which in civil practice is scarcely ever under consideration. He must keep in mind the old discarded methods in use before aseptic surgery was known, and determine if one of these is not preferable to modern operations depending on strict cleanliness and asepsis. He who has such a problem to solve is not to be envied for he has the soothing knowledge that surgeons learning of his treatment but ignorant of his surroundings will be quite apt to condemn him for not being up to date in his surgical knowledge.

A few of these problems of surgical treatment are now being solved by the railroad surgeons of the country, in their systematized efforts for the care of the wounded of railroad accidents. In many cases the conditions of military and railroad accidents are identical and the procedures used in one case are proper for the other. Can we not look to the railroad surgeons for information that would be invaluable to future wars?

Then again is the question of the new firearms, that carry so far and so accurately, that battles will be fought with much greater distances between the belligerents. This will necessitate the field hospitals being much further in the rear than formerly, perhaps many miles, and it will take a much longer time to carry the wounded to the hospitals. Many serious injuries will not stand such transportation. They can not be abandoned to their fate and it may be necessary to operate for their relief whether asepsis can be achieved or not. The greatly extended danger space of modern firearms may make it impossible to reach the wounded. The safest place on the future field of battle may be with the line of skirmishers, and the most dangerous space a thousand or even three thousand yards in their rear, just where collection and dressing stations and even field hospitals were formerly

placed. Whether it will be possible to get to the wounded is an open question. It is quite possible that during engagements the soldiers will have to be their own surgeons, and that it may be impossible to aid them or even reach them until the line of battle has so shifted that they are out of the danger space.

This brings up the final question of the amount of time the military surgeons may have in which to do their work. Military officers are divided among themselves as to the time it will take to decide future battles. Some think that with the new weapons the battle may be over in as short a time as 30 to 60 minutes, while others believe that with the long ranges accurate observations will be impossible and whole days may be occupied by both sides in various manouvers, calculated to feel the enemy's strength and position. In the latter case everything may be done leisurely and without confusion. In the former case the field hospital will no more than get in running order when the army will be pushed forward or in full retreat, leaving the surgeons to care for the enemy's wounded on the one hand or none at all on the other. The retreat might possibly be accompanied by such a disastrous fire by the advancing enemy that it will be sure death to remain, as provided by the Geneva Convention, and every surgeon may be ordered to pack up and leave his wounded to the care of the enemy.

As to the actual amount of surgery to be attended to in future wars it is scarcely possible to form any conclusion. The opinions of military men as to the destruction that will be seen vary somewhat; while it is sometimes thought that there will be less than formerly, others declare that the number of casualties will be very large. Statistics on this point will give no certain data for the future. We all know that in ancient times the weapons were not destructive at all, and we know that every improvement in weapons has increased their destructiveness. Yet statistics show, and we know it to be a fact, that while ancient battles were mere slaughtering contests, armies often being annihilated, the modern battles show a smaller and smaller percentage of casualties and a larger and larger number of veterans who return to their homes. Of the several millions of Northern soldiers who served during the rebellion only 300,000 lost their lives from disease and injury. This progressive lessening of mortality has been pointed out as due to the progressive enlargement of the armies. When an ancient army of 5,000 men entered a fight every man had a chance to fight, but when a modern army of 1,000,000 men meets the enemy perhaps two-thirds of them may not be very actively engaged. There are no statistics available which show the actual percentage of

casualties among those engaged, so that it is quite possible that every increase in the effectiveness of weapons really is accompanied by increased destruction of the soldiers who do the real fighting. The lessons of late wars show that the brunt of the battle falls on special regiments or brigades, whose surgeons are overworked while others are idle. It is reasonable to suppose that this fact will be still more emphasized in future wars, and in order to distribute the surgery more evenly it may be necessary to establish a single operating hospital at a greater distance in the rear, so as to be available to a greater part of the line than a division, and so as to have a larger staff of surgeons and assistants. This will be possible only when there is proper transportation, far better than in the past.

A reprinted article by Surgeon Captain F. P. Nichols, in the May number of the Journal of the Military Service Institution, discusses the conditions that will make such changes in the number and character of the wounds of future battles. It will repay study. It can not be discussed here beyond mentioning the four items connected with these changes:

1. Concealment of fire by the use of smokeless powder.
2. Increased effectiveness of rifle fire by weapons of longer range.
3. Carriage of an increased number of rounds by diminution in weight of cartridges.
4. The concentration of fire by means of repeating or magazine arms.

He shows the necessity for greater distances between the fighting line and the field hospitals and the changes in transportation necessary. He also discusses the number and kinds of injuries to be expected and the necessary changes of organization of the medical department. He concludes that there will be an increase of wounds amenable to treatment, a small increase of severe wounds and a large increase of the dead. The surgeon will have more to do, but have more patients to recover from his operations.

NEW KINDS OF GUNSHOT INJURIES.

The new weapons, with slender hardened bullets of fearful velocity and long range, will surely make wounds that we never now see. What these wounds will be like can only be surmised. We were first told that the bullets went straight through bones without shattering them, and this knowledge came from experiments on dead horses. Now we hear of certain accidents to men, wherein the new

bullet broke into pieces and tore around through the tissues, causing most terrific destruction. The latest experiments show that the bullets are very destructive to life if fired into the abdomen. In passing this problem it may be surmised that we are likely to have injuries that are so destructive to tissues as to necessitate entirely different modes of procedure to those we now consider proper.

Perhaps with the new bullet-proof clothing we may have a still further class of serious injuries. A German has been reported as making a thick felt clothing, within which are placed some layers of wire gauze. It is reported to turn a bullet from a modern rifle. If this is so we may not expect the man to escape injury, for the terrific momentum of the bullet must be taken up and distributed before the motion ceases. A man shot will fall wounded as before, and though there may be no external wounds there may be internal and fatal congestions or a fatal paralysis of the heart. Again, these cases may linger on for a long time and in them it is reasonable to report an entirely new class of gunshot injuries.

TRANSPORTATION OF THE WOUNDED.

The question of the transportation of the wounded men, the methods of picking them up, lifting them on and off stretchers into ambulances, carts, etc., and caring for them en route so as not to aggravate their injuries, has been occupying military surgeons for some time, and you have had practical illustrations of the results. It will be a waste of time to tell you of the importance of much drill in these things to make the men of the hospital corps experts. The only question is how to convince the line officers of its necessity. They must be convinced or they will not give that willing co-operation necessary for success. The sight of a drill in picking up wounded men is apt to provoke a smile like everything else new, but he who smiles becomes serious when informed that in the condition of battles bungling and ignorant methods at lifting the wounded may result in the death of two to five in every hundred. The thought that he may be one of the five makes him quite willing to have some experts in this matter in his organization. Then, again, any objections to the time occupied to learn such a simple thing are silenced by pointing out the great length of time occupied in teaching a soldier such a simple thing as sighting a gun, an operation that some of us have learned in ten minutes. In other words, the more everyone is informed of the importance of the work of the hospital corps the more aid will we receive from the line in carrying on the work of humanity to armies.

In European armies the railroads are looked upon and are the basis of military operations and are in many cases directly under the control of the central government. Hence the question of the transportation of the wounded by railroad is in the hands of the proper officials. In this country, where all railroads are private affairs, we do not profit by the arrangements that the railroad surgeons are making for this one object. Recent years have seen such development of all plans of railroad surgery that we can now confidently expect much information from the railroads. It would be a valuable contribution to our knowledge of military surgery to have full descriptions of every little detail of railroad transportation of wounded, where every military surgeon can learn of them for adaptation to the needs of the army.

MILITARY NURSING.

The problem of nursing of the sick soldier is being solved in the United States Army. Civil practitioners long ago found out the necessity of having trained nurses in the management of hospitals, and the efforts to convince people of the need of trained military nurses in an army followed the usual rule—that it has taken a long time to make it perfectly plain that they were necessary. A systematic course of instruction for military nurses has not yet been evolved, and it is not yet known how much can be accomplished in a short period of service. It can safely be stated that if it takes two or three years to train a nurse properly we would not have time to train them if war were suddenly proclaimed, so that we should have trained nurses in all military establishments in time of peace.

MILITARY FOOD AND MILITARY CLOTHING.

The sanitary requirements of military food and of military clothing are great problems, requiring much study and investigation. It is high time that armies should profit by well-known yet recently-acquired knowledge of these subjects. Well-directed efforts in this direction will be of service to soldiers, as every one acknowledges who has given the matter the least thought. It seems essential to tie the soldier down with straps and strings and then load him up like a freight car. He is half choked with high-standing collars; he has straps ingeniously arranged across his chest so that he can not breathe by his chest muscles; he has belts and clothing so tightly bound around his waist that he can not breathe by his abdominal muscles, and on his head is placed a contrivance that is protection neither to eyes nor head; and with it all he stands in a stiff, unnatural position, which of itself can

do no good. After all this it is wondered why he suffers from vertigo and sunstroke. It almost seems as though the soldier, fully accoutred, is expected to develop a new method of breathing by means of his diaphragm and perineum. We will have to dub this *military respiration*. A recent change in clothing is an actual retrogression, instead of an advance.

EFFECTS OF MILITARY SERVICE.

Then there are such important subjects as the mental and physical effects of a long military service. In addition to the diseases incident to camp and garrison life, there are well-marked characteristics of soldiers, due to their habits of life and their environments. No doubt this big field would be fruitful if properly gone over. In the one item of the supposed changes in the eye due to the strain of target practice possibly we might find something of interest to military surgeons.

MILITARY MEDICAL EDUCATION.

The foregoing problems indicate in what directions a physician should be instructed in order to make him an efficient military surgeon. In addition to these, there is a subject which is generally considered foreign to his duties, yet its neglect is often fraught with much danger to the health of armies. It is the custom, whenever possible, to drive herds of food animals along with the troops, slaughtering the cattle as required. This herding of large numbers of animals together is a bad practice, because epidemics of disease among the animals have at times caused such great sickness among the troops as to disable the army. The medical officer who is looking after the health of the troops can not foretell any such catastrophe unless he is versed in that part of veterinary medicine. He must be sufficiently learned to be able to recommend measures of prevention, and to be able to recognize danger as soon as it appears. The introduction of frozen beef may, by the way, obviate all future necessity for carrying along live food animals with armies in the field.

The great art of preventing disease among troops is, of course, a branch of general sanitary science modified to suit the special conditions found in armies. The military surgeon's duties being advisory only, he must expect to find his recommendations disregarded when military necessities so dictate. For instance, troops may be encamped in such an unhealthy locality that the soldiers are rapidly becoming disabled, yet for some military reason it might be disastrous to remove them. The medical officer's report having been made, the responsi-

bility rests in great part upon the commanding officer, yet not wholly, because the surgeon is invariably blamed if any disastrous results follow. If it was a mistake to suppose that the soldiers could not have been shifted to a better locality, all will come in for a share of popular blame. Considerable knowledge of the art of war and of the military purposes of the campaign will be of great aid to medical officers in enabling them to render the best and most useful sanitary advice. He can also know how far to go in repeating recommendations that have once been overlooked. The proper performance of his military duties requires a surgeon to be well informed on military topics. He is quite apt to inhale the necessary knowledge from constant immersion in a military atmosphere, but at first he is ignorant of these matters. Military medical education should therefore include elementary instruction in the art of war, and the more of its general principles a surgeon knows, the more efficient will he become.

LITERATURE.

Finally, it may be remarked by many that the solutions of these questions are plain enough and have been frequently discussed. If this is so, it emphasizes the vast importance of having our knowledge of military medicine collected into definite form, so that all military surgeons can learn from the experience of others. Reports, papers, discussions, and the results of late wars are not always published in such shape as to make them available. Indeed, there is so much to be learned from such engagements as those in Chili or in the last Sioux outbreak that it seems astonishing that the results have not been available for all military surgeons. It is to be hoped, therefore, that every one who has anything to contribute will drop his mite into the common treasury and enable us to have a definite and recognized science of military surgery. There is enough talent among military surgeons of this country alone to build up an encyclopædia of military surgery such as those great works on obstetrics, diseases of children, medicine, surgery, etc., that the last decade has brought to light. If every one puts his shoulder to the wheel we can bring military surgery to its recognized place of importance. All this work must be done by men thoroughly conversant with military problems, for, without such knowledge, false deductions will constantly be made. All military medical matters should be so thoroughly written up that the young military surgeon can have something from which to learn his duties and steer clear of technical errors that it now takes years of experience to avoid.

No science can exist in a highly flourishing state without its literature. The associations of the scientists serve a highly important object, but if the meetings are at long intervals there is a loss. Ideas do not keep well; they undergo a natural decay, and there is no antiseptic methods of preserving them except by packing them away in appropriate periodicals. The backward condition of military surgery at the beginning of every great war is in part due to the lack of these two things, associations and literature. Having the association, it is to be hoped that we can now get up the literature. Various attempts have been made to support a journal devoted to a special branch of military or naval medicine, but they have been failures owing to the limited field. We now have the field enlarged, and a journal of military and naval medicine should be a decided success. Both a military and medical school and journal were projected by the Surgeon-General of the Army at the beginning of the war, but both were strangled by their enemies in the very act of being born. So the idea is old, and let its accomplishment be new—one of the achievements of this association. One year ago the writer carried on considerable correspondence with many military surgeons on this topic, thinking it new. The responses made were quite encouraging, and subsequent promises of support have been still more encouraging. It is quite probable, therefore, that this military medical problem—a special literature—can be solved if we all wish it solved. All it wants is financial and literary support from every man interested in the numerous branches of military medicine.

THE QUALIFICATIONS FOR AND THE STATUS OF A MEDICAL OFFICER IN THE NATIONAL GUARD.

By Lawrence C. Carr.

Major and Surgeon Ohio National Guard.

In seeking information upon the subject-matter of this paper I discovered a condition of things which has much to do with the status of the medical officer, and a great deal to do with deterring men of proper qualifications from entering the service of the National Guard, viz.: I, personally, as a National Guard officer, communicated with the several adjutants general of the forty-four States. Within thirty days I received but twenty-one answers, nor could I receive other answers to repeated communications.

In this dilemma I called to my aid Capt. H. O. S. Heistand, of the 11th Infantry, U. S. A., who had been detailed by the War De-

partment for service as inspecting officer for the Ohio National Guard. He succeeded in securing for me answers from twenty-two of the twenty-three delinquent States.

Now this association will pardon me if I say that the above statement needs no comment. I am certainly under many obligations to Capt. Heistand for aiding me at some inconvenience to himself in securing copies of the military laws of the States mentioned.

While on this subject I will take the liberty of stating that during the past year I have had the honor of serving upon one of the association committees as its chairman, and in that capacity I have found it necessary to communicate on several different occasions with the members of the committee. Three of the members have answered all communications promptly; three others have religiously refrained from paying the slightest attention to any of the communications sent to them.

Now if we are to consider ourselves medical officers we must not neglect that, which to neglect in the regular service would be an unpardonable offense, namely: failure in sending an answer, as soon as practicable, to any communications received on military medical subjects. We must always bear in mind that if we wish to command the respect of others we must have respect for ourselves.

In looking over this rather unique library of military laws of the different States, I was surprised at the perfect unanimity with which all laws exact no qualifications from a medical officer (I will here except two States), while on the other hand, in the majority of States the qualifications required for field and line are such as to insure the services of competent men.

At the present time, to the extent of my knowledge, the only requisite necessary to secure an appointment as medical officer in the National Guard of the United States is simply some slight influence with the commanding officer of the regiment. In some instances, whether the applicant be a dentist or a veterinary surgeon, it seems to make no difference so long as he is entitled to call himself "Doctor."

Of course, to secure the higher positions, such as surgeon-general, for instance, another qualification is of vital importance; that is, the successful candidate must have a fair amount of political pull in the neighborhood from which he hails.

In regard to the qualifications required by law from a medical officer of the Guard, you can readily see there is absolutely nothing to say; but, as to the qualifications necessary to secure a competent

medical officer in the National Guard at the present time, that is an entirely different question.

While rapid advancement has been made in procuring proper legislation in the last five or six years for the betterment of the field and line officers, and the National Guard, as a whole, it is humiliating to admit that no legislation tending to elevate the standard of the medical department has been enacted, with the possible exception of the two States as before mentioned. This fact of itself is a disgrace and a menace to the medical department of the Guard.

Physicians and surgeons properly qualified to practice their profession would feel it beneath their dignity to accept positions as medical officers in at least two-thirds of the States of the Union.

This is also self-evident. To put it as tersely as I can, in the regular service the respect is paid, in the first instance, to the rank held by the man, and secondly, after acquaintanceship, owing to the training that medical officers of the regular army usually have, the respect comes for the man. In our service the converse of this proposition is true. The rank and file of a National Guard regiment must first respect the man, because it is only of late years that the rank held by a medical officer has had any consideration from them. Of course, starting in with the respect for the man himself, it is easy for such an officer to cause any organization with which he is connected to also respect the rank which he holds.

This fact is, in my judgment, one of the serious difficulties the medical officer in the National Guard has to overcome.

The lack of courtesy from field and line to the medical officer in the Guard is not so glaring at the present time as it was some few years back. The reason for this is, that the class of men who now accept positions as medical officers is far in advance of the class such as was appointed at the time referred to.

This simply proves the truth of the assertion that I made above: that the man commanded the respect of officers and men, and respect for the rank of a medical officer naturally followed, thus inducing the better class of men to join.

No qualifications being required under the laws of many States, it is impossible to get the class of physicians and surgeons who would be an honor to the medical department and of great assistance to the National Guard itself to accept the positions of medical officers.

I regard it as the duty of this association to look to it that efforts are made to procure such legislation in the different States as will

cause men to consider it an honor to be appointed to positions in the medical department of any State Guard.

As I stated in a paper I had the honor of reading before this association last year, single efforts, in two or three States where such legislation could be secured, instead of being a benefit to the Guard, as a whole, are rather a detriment. The effort should be a general one if we are to hope for any definite result.

The medical officer in the Regular Army has complained bitterly in the past of the lack of courtesy shown him by the line officers.

I give here some extracts from a paper published in the Journal of the Military Service Institution for January, 1893, entitled "The Place of the Medical Department in the Army;" the author is Lieut. I. R. Williams, of the 3d United States Artillery.

I give the extracts without comment solely to illustrate my meaning and showing the feeling which exists even at the present day.

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The Government has provided for the cure of bodies of men, in the army, a medical department; and for the cure of bodies of horses, in the cavalry, a number of veterinary surgeons. In the former class the surgeons are commissioned officers and have a species of military rank, and in the latter they have no commissions and no legally established military rank, but aspire to both.

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In the line of our army, the question of rank is hardly separable from the question of command, either of troops or of certain territorial units, which may be either posts, departments or divisions. In the military or quasi-military departments of the staff—as the engineers, ordnance, the quartermaster's and subsistence departments, the question of rank still remains associated with the idea of eligibility to command.

There remain what were originally the civil departments of the staff, the paymasters, surgeons and chaplains, who, performing civil duties, originally had no military rank. Gradually these classes became commissioned officers but without military rank proper. Then, step by step, they acquired "assimilated rank" entitling them to corresponding military precedency, but not to command, nor even necessarily to military title.

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The statement that "among these officers who have rank without command are medical officers and pay officers," is not intended to deny these officers command in their own departments. The law,

while not expressly conferring upon them the right to command in this case, recognizes this right by implication. In the case of paymasters, the original law concedes them the right expressly (Act Mar. 3, 1847). Chaplains have never been organized into a department; hence a post chaplain has no more connection with any other post chaplain than he has with a regimental chaplain, and the limitation upon the chaplain's right to command amounts to an absolute prohibition. As far as the army at large is concerned, it is evident that the rank of all three classes—surgeons, paymasters and chaplains—is of the same sort.

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However, at that date, 1868, a false practice was springing up. Thus, in the same order quoted above, we read: "Major Simeon Francis, Paymaster. Seriously, if it is proper to address a paymaster as Major A. B., Paymaster, etc., it can not be improper to address a medical officer as Major C. D., Surgeon, etc.; nor can these officers seriously object to the style of Second Lieutenant G. H., Teacher of Music, U. S. M. A., or to Major I. K., Chief Veterinary Surgeon, etc., designations which have been actually proposed.

To the thoughtful line officer, however, all these designations are improper. Some officers, never having known a different custom, give without scruple military title to the paymaster, while they hesitate to give it to the surgeon. Logically the reverse should obtain. The surgeon is the associate and comrade of the line officer wherever the line may be stationed; while with the paymaster, the line officer has rarely any comradeship whatever. The paymasters are as a rule greater ticklers for the military title than the surgeons are, and the demand of the civilian pay officer for this title would be laughable to the line, if it were not extremely offensive.

It has been urged that army surgeons have performed duty under fire, and have volunteered for dangerous services, and in particular, that Assistant Surgeon Crawford commanded a battery in the defense of Fort Sumter. It is also true that an assistant paymaster of the Navy was with Cushing in his daring attack on the Albemarle, and that in defense of Sumter there were other volunteers than Dr. Crawford; for example, a New York police sergeant and some engineer laborers. Honor to all these men; but the greater honor to such as risked their lives without hope of reward, and upon whom the Government had no possible claim for service.

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Why the rising generation of medical officers should object to a style of address in use from the origin of their department is not easy to understand. The writer's grandfather, a medical officer of the old army, never objected to the style of "Doctor" and with most of the older medical officers of to-day it is believed the question of pay is more important than the question of rank and title. That the medical officer will be in any way improved, save in their own estimation, by using the style of Colonel or Major, is difficult to believe. The demand for these titles strikes the line officer as more offensive than the refusal of them can possibly strike the medical officer. The line does not begrudge the medical staff their rapid advancement in rank and pay. Let not surgeons begrudge the line and military staff an exclusive use of titles only appropriate to military pursuits.

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As I have said above I will pass over these extracts without comment, although the temptation so to do is strong.

Now pause a moment and look at our position, not alone as medical officers, but also as officers of the National Guard. Three officers, the ranking one a "Major," convene together as a board to revise the Guard Manual of the regular army. In all clauses of that manual, where the courtesies due to rank are mentioned, National Guard officers of every State are omitted and, according to the "Guard Manual," they are entitled to such courtesies only when in the service of the United States as volunteers.

I do not mean to say that it was the intent of these officers to snub the National Guard of this country, nor do I believe it was; yet where people are sensitive and slights are looked for, all ambiguity that could be construed into a slight should be carefully avoided.

(Paragraph No. 259 from "Manual of Guard Duty.") All guards and sentinels will pay the same compliments to civil officers of the Government, to officers in the military or civil service of foreign powers, to officers of the Navy and Marine Corps, *and to officers of volunteers and militia when in the service of the United States*, that are directed to be paid to the officers of the army of corresponding rank.

I simply cite this paragraph to show my meaning: that where officers of the volunteer or militia are mentioned courtesy is to be shown to them only when in the service of the United States.

I also call attention to the following from paragraph No. 181: "*Officers of marines, and of the volunteers and militia, when in the*

service of the United States, are entitled to the honors due to like grades in the regular service."

Of course, the inference to be drawn from these paragraphs is only one and that is, the volunteer guard officers are entitled to the courtesy due their rank only when in the service of the United States.

That this discrimination has been made with some particular object in view is possibly a fact, but we who are most affected by its ruling are in absolute ignorance of its cause.

While it has been proclaimed universally that it is the wish, as well as the aim, of the War Department to support and strengthen the guard on every occasion and to do all that they can to make self-respecting men enter the service in the different States, some of the decisions emanating from the War Department, to say the least, are capable of another construction.

Notably so the decision in regard to the project of General Miles. On the 3rd of May, 1893, General Miles called the attention of the War Department to many reasons which, in his judgment, would make it advisable for a general encampment of the regular army and the National Guard at Chicago during the Columbian Exposition.

I append here the reply of the War Department and the answer to same from General Miles:

The following is the reply of Adjutant-General R. Williams:

WAR DEPARTMENT, ADJUTANT-GENERAL'S OFFICE,
WASHINGTON, May 24th, 1893.

Major-General Nelson A. Miles, Commanding Department of Missouri, Chicago, Illinois:

SIR: Referring to your communication of the 3rd inst. in the matter of the proposed encampment at Chicago during the Exposition, for both regular and State troops, I have the honor, by direction of the Honorable Secretary of War, to inform you that the same has received his careful consideration, as well as that of the Major-General commanding the army, and concerning which he desires me to remark as follows:

While it is not stated in your communication of the 3rd inst. that any rent is to be paid for the use of the grounds that have been offered it is inferred that the use of same is to be free, but apart from this or any other question of expense, to collect in Chicago the garrisons of Forts Sheridan, Wayne, Brady and Mackinac would be equivalent to stripping these posts of all garrison for the time duringwhich the encampment in Chicago should last. The only experience acquired by these troops would be simply that of a railroad or steamboat journey for two or three hundred miles, and the benefit derived by such experience would be extremely small. Neither is it seen that any benefit to them would be derived by their being for a short time associated with the National Guard of the different States. In so large a crowd and mixed up with civilians,

as they would be, many cases of indiscipline must naturally occur, which would more than outweigh any benefits derived. So far as can be seen, the only practical result would be the giving the officers and soldiers an opportunity to see the Fair.

To put the National Guard of any State in such a camp, subject in its police regulations to the Major-General commanding the department, and in its military regulations to its own immediate commander, a condition would be produced which, instead of being beneficial to the National Guard and the regulars, would be apt to injure the good feeling which exists between them. Whatever police regulations the department commander might establish would be effective only so long as the officers and men of the National Guard saw proper to submit to them, and it is doubtful whether submission of that sort on their part would be of long duration.

For these reasons, as well as the fact stated in your communication of the 3rd instant, that a bill to carry a similar plan into operation was introduced into the last Congress, which failed to receive favorable consideration of either the Senate or the House of Representatives, your application is disapproved by the Secretary of War.

Very respectfully,

R. WILLIAMS,

Adjutant-General.

HEADQUARTERS DEPARTMENT OF THE MISSOURI,
CHICAGO, Illinois, June 13th, 1893.

To the Adjutant-General U. S. Army, Washington, D. C.:

SIR: I have the honor to say that in my communication of the 3rd ultimo it was understood that the grounds for an encampment of United States and State troops are tendered free of expense. In suggesting that troops from Forts Sheridan, Wayne, Brady and Mackinac occupy a part of the camp, it was, of course, understood that a sufficient guard would be left at these posts to protect the public property, the same as is always done whenever a garrison leaves a military station.

As the grounds had been tendered to the United States military authorities, it was believed to be an act of courtesy to the State troops to offer them the use of the grounds for their encampment certain days during the season. This has been frequently done. The State troops have occupied government reservations, target ground, etc., in fact I have seen them bivouacked in the corridors of the War Department, and do not know of any case where they have misused the hospitality and courtesies extended to them by the United States authorities. Any officer who would accept such courtesy and hospitality, and who would misuse or allow his command to do so, would be guilty of unofficerlike conduct.

The only object I had in making the recommendation was to afford the United States troops an opportunity of witnessing the drills and manœuvres of large bodies of men which is something that many of the young officers have never had an opportunity of witnessing, and at the same time afford the State troops an opportunity of camping in large bodies where they would have all

the facilities for inspection, drills, manœuvres, and have the advantages of seeing the condition of other troops besides their own.

The advantages of the government furnishing the tentage is apparent when it is considered the long distances that they would have to transport their camp equipage, and the liability of the ground to become damp during the time that the ground would be unoccupied between the encampment of one command and that of another.

The proposition for the encampment would be one of great economy to the State troops over the expense of accommodations in hotels, boarding-houses and other places. It would be safe to estimate that it would be saving to the State troops of at least $900,000.

It is possible that the plan could still be carried out if authority was given by telegraph, and the telegraph was used in communicating with the Governors and Adjutants-General of the different States.

Even if the plan suggested by me is not adopted the State troops could find accommodations to a limited extent on grounds not so extensive, but nearer the Fair Grounds, by communicating with Mr. Robert Greer of Chicago, who supplied some fourteen thousand troops last October, and who is now supplying the two companies of regular troops that are now encamped on the grounds at present. His proposition is to furnish food, water and sanitary accommodations for seventy-five cents per day per man, the troops to furnish their own tentage, board or straw flooring, blankets, etc.

In accepting either proposition the troops would, of course, be governed by the laws of the State of Illinois and the ordinances of the city of Chicago during their sojourn in this city, the same as they observe the laws of the States where they pass through on similar occasions.

Very respectfully, your obedient servant,

NELSON A. MILES,

Major-General Commanding.

I have unwittingly gone beyond my original intent of confining myself to the Medical Department of the National Guard, but I may be pardoned for we all know that what affects the guard must, *per se*, affect the medical department.

While this association knows that the Medical Department of the Regular Army is in perfect accord with us, and while I personally know that Major-General Miles is heart and soul for the interest of the Guard as a whole (having heard him at a Loyal Legion banquet, early in this year, pay a compliment to the National Guard, the sincerity and earnestness of which was beyond question) still, with the charge of egotism staring me in the face, I say that the letter from the War Department, in view of all the facts, is capable of any construction other than complimentary to the National Guard.

Such papers as this may be the subject of severe criticism, but it is only the calling attention to faults that renders a remedy possible.

General Senn gave us a paper last year on colleges, and I saw, some two months since, that such a college, not on the scale proposed in his paper, had been started in Washington as a preparatory institution for young surgeons who had passed the examination previous to their entering on actual duty.

Now, while I have endeavored to point out the apparent insincerity of the regular army, the faults of the Medical Department of the National Guard, and faults of the National Guard also, I sincerely trust that my paper will not be taken as the vaporings of an iconoclast because I have spoken simply of their faults. If I were to attempt to speak of their virtues, many papers of much greater length would not be sufficient to enumerate them.

The paper of Major Carr was discussed at length by Major Briggs, Colonel Henry, Lieutenant Clark, Captain Mann (Wisconsin) and Colonel Irwin.

THE MEDICO-LEGAL STATUS OF THE MILITARY SURGEON, AND A RESUME OF RULES AND REGULATIONS FOR THE GOVERNING OF THE MEDICAL DEPARTMENT OF THE NATIONAL GUARD OF THE UNITED STATES.

By J. Adelphi Gottlieb,

Major and Surgeon-in-Chief Auxiliary Military Medical Corps; Instructor of Ambulance Corps, Cadet Corps, First Battery, N. G. S. N. Y.

Military Surgeons of the United States, in selecting the subject represented in the title of my paper, I have no need of making any apology for taking up your time with a subject not strictly medical or surgical science. My motives for selecting it were these: We are all interested in elevating the standard of the Medical Department of the National Guard, and whatever is contributed toward this aim may prove of value; and, secondly, for not taking a subject purely medical. It is evident, by scanning the roster of our association, the names of those authorities eminent in medicine and surgery will be found as members, for whom I leave this field of directing the progress of medicine and surgery.

After reading the various articles in the volume of transactions of the second annual meeting of this Association, I noticed quite a number of references made by surgeons, to the existing friction between the line and medical officers, the apparent disregard that line officers and commanders have for their medical officers, thus rendering the duties of the surgeon in these instances very unpleasant, and handicapping him in directing the progress of his department.

Odd as it seems, I have inquired into the matter, and, to my astonishment, found that friction between line and staff officers to be a fact. From conversation with officers of the army I have solved the cause of existing controversies and of the none too pleasant feeling of the line toward medical officers. All this ill feeling alluded to, on the part of the line officers, is that they were, and are, laboring under a false impression; they fear that the medical officers, clothed with military rank and title, would aspire to actual military command, thus thinking a surgeon commissioned with the rank of major would exercise military command over, perhaps, the line officer who has been laboring many years to obtain the rank of captain, etc. To remedy this undue and unfounded fear, these officers made all attempts to have the medical officers discard all military rank and title, the latest of which is the disputing of the right to military rank and title of medical officers, saying that the rank is "assimilated" and not "actual." Thus we have the cause of the line officers' disrespect.

To use the words of Surgeon Lindley in his paper of last meeting, "the attention of those commanders who are indifferent and bigoted should be drawn" to the services and value of the surgeon. Indeed, it is strange that the tyranny to show the right to command by line officers over the medical officers is alluded to by surgeons of a number of States, particularly those who have no well-organized medical department.

It may, perhaps, become apparent that some line officers may derive benefit by "reading up" and posting themselves on medico-military matters; and also, for the benefit of the surgeon, I will review the right to rank and title of medical officers.

This subject has been well discussed, particularly in the United States Army, where a number of line officers have maintained that medical officers have no military rank, referring to the surgeon as the "civilian who heals the bodies of men, and the chaplain who cures their souls, and whose duties do not vary with or from civil life."

In answer to these controversies, and with a view of settling the status of the medical officer on a final and authoritative basis, I can not do better than to quote in full the able answer to a criticism on the title and rank of medical officers, by Colonel Chas. R. Greenleaf, Deputy Surgeon-General United States Army, in the Journal of the Military Service Institute of March, 1893:

"The Court knows nothing of the intention of an act except from the words in which it is expressed applied to the facts existing at the

time, the meaning of the law being the law itself." (Enderlich on Interpretation of the Statutes ¶ 8.)

Stripped of its verbiage and historical references, existing arguments deny to officers of the medical department actual rank and title inherent to it, and claim that whatever rank these officers may have is "assimilated," and therefore without rightful title. Assuming that this epitome of the article is correct, an examination in accordance with the text above quoted from Statutory Construction and Unwritten Law, of the statutes creating the medical department and legalizing the status of its officers, may not be without interest and possibly profit to the writer of the article and to those who think as he does.

In section 1168, R. S., which details the organization of the medical department, the several grades, from Surgeon-General to Assistant Surgeon, are coupled respectively with the rank of Brigadier-General to First Lieutenant, there is no ambiguity in the wording of this statute. No such qualifying adjectives appear as "assimilated," "relative," "quasi," nor yet the more specific prefix, "species of military;" only rank, and nothing more.

Section 1342 defines the word "officer" as including commissioned officers, and section 1174 specifically mentions "officers of the medical department." Being officers, they are entitled under sections 1243-1260 to retirement; and in sections 1256-1257, relating to rights, liabilities and vacancies, the same unqualified notation of rank appears, except in one significant instance, where section 1254 declares that officers "shall be retired upon the actual rank held by them." Furthermore, in the act of Congress approved July 27, 1892, fixing the status of certain medical officers, this language is found, unqualified and unequivocal: "Those holding the rank of Colonel." Surely, "the meaning of the law being the law itself," what status can be given a medical officer other than the unqualified rank the law has declared for him?

Apply these texts to the question of title, the law is equally explicit, section 1212 declaring that "no officers shall be addressed by any title other than that of his actual rank."

All military positions are dual in character, consisting of an office and a rank; the former is defined as "a position to which certain duties are attached" (Century Dictionary); the latter is a "titular distinction," that gives authority and dignity to the incumbent, and carries with it the pay and emoluments necessary for his support. In the line the office represents the arm of service; in the staff it repre-

sents the department; to each there is inherent a title, and the law directs that of the two the title of rank shall be used.

There is no authority either in law or regulations for an officer of the army to use the title of the doctorate or any other civilian profession or occupation, nor does the technical "custom of service" justify it; an interpretation of this phrase is a dangerous expedient in an argument, because it can only be used with success in the absence of written law or when it is "not in conflict with existing statute or constitutional provision" (Greenleaf Evidence, ¶ 251). Nor will any traditions, be they ever so hoary with age, justify it. "An illegal or unauthorized practice, however frequent or long continued, can not constitute a legal usage" (Winthrop Military Law, p. 45).

The scope of duty required of a medical officer is by no means limited to the "cure of bodies of men in the army," but by law and regulation includes the sanitary supervision of the army, and many other military duties that pertain to officers in general, to perform which the law has wisely invested him with the necessary authority. It was the possession of this authority that enabled him, during the war of the Rebellion, to organize and administer a military sanitary service that has been the admiration of the world, and has given to foreign armies a model upon which their present splendid sanitary organizations are based, and for which they give us unstinted praise.

In its continued possession and more complete recognition the medical officer sees the way for a finished system which by its carefully prepared methods and tactics, its well drilled and thoroughly disciplined personnel, will free the fighting line from what has, on many an occasion, been a fatal encumbrance, and vastly increase the efficiency of the army with which it has the honor to serve.

The medical officer lays no claim to anything that is not his legal prerogative; he finds that the law gives him equal rank with his fellow officers, and requires him to wear the uniform and use the title belonging to that rank, and he obeys the law, not "offensively," but so far as my observation goes with quiet dignity and strict propriety.

He fully appreciates the fact that his comprehensive work can never be properly done unless he follows closely the law under which it is carried on, and so far in the history of his corps he has the proved consciousness of having won by his work the officially expressed commendation of all his superiors.

Thus, with such an able, clear and concise statement of the facts, the true status and standing of the medical officer is well fixed by au-

thority, and must relieve all doubt as to the legality of their right to military rank and title.

It is not necessary to state that it is not the surgeon's main object to aspire to military rank, or that I do not offer this defense on that account. For the surgeon is the medical officer and does not intend to be anything but such, and his being commissioned with military rank is for the purpose of facilitating the discharge of his duties; and as actual military service has proven this to be essential, inasmuch as it secures for the medical officer the obedience and respect of his inferiors, and placing him on an equality with the other officers of the different arms of service of similar importance.

Having viewed the feeling of line officers toward the staff, we may ask, what can be done to have officers and enlisted men appreciate our services for them? The answer carries the remedy. We must have a well organized and independent medical department, of the highest standard; then the respect will come from itself. Surgeon-General J. D. McGill, of the National Guard of State of New Jersey, says in his report for 1892: "No active service, no staff department of any army, is of greater importance than the medical. Let the mind of the soldier be impressed with the conviction that if he is injured or falls sick he will receive intelligent and competent treatment, and his courage is increased."

In glancing over the militia laws of the various States, I have noticed some few make provision for a "medical department," others have provision for a "medical staff," but that staff who have it in their power does nothing toward its advancement of making it a permanent department; other States, and quite a number, have but a mention that a surgeon should be attached to each regiment, giving the right to each surgeon to administer in his department as he sees fit, whether he is capable or not; for his appointment in the hands of the commandant he chooses invariably for political and social reasons only.

Thus, in accord with the objects of our association, we should strive to have uniform rules and regulations governing all the States of our Union—a law of the highest standard—and each State organization should act in accord with it, making such additions as will suit the individual State.

With a view of making the beginning, to have a medical department of the highest standard, for the government of the Medical Department of the National Guard of the United States I have compiled the following from every available source, including my slight

experience as organizer of the Auxiliary Military Medical Corps, the personnel of which are first and second-year medical students, who act as members of the Ambulance Corps and Hospital Stewards, respectively.

The medical department of each State should be independent, and on a similar basis to that of the United States Army.

Medical officers should not be appointed by the commandant and chosen for his individual reasons; for as it exists in almost all States, with but few exceptions, a surgeon may be appointed to a troop, battery of artillery or battalion, and ranks as assistant surgeon and first lieutenant, however talented, and another, more fortunate through the colonel's appointment, is commissioned a surgeon and major, though perhaps not as well qualified as the former, both standing no chance to be promoted, and serve in the same capacity as long as they are connected with the department.

The first and only proper thing to do is for the members of the medical staff of each individual State to make an attempt for independent organization, and as Surgeon-General McGill, in his report remarks, "Centralization of directive power is an absolute necessity for the effective conduction of a military department."

The medical department should be controlled by either a Surgeon-General or Medical Director, according to the strength of forces in each State; by the following rules it is only intended to serve as a guide to organization and permanent establishment, and is by no means as complete as each individual State medical staff can make it by collective efforts of its members.

ORGANIZATION OF A MEDICAL DEPARTMENT.

1. The whole governing power of the medical department should be invested in medical officers especially qualified for that purpose, who act in accord with the military laws of each State, but who have chief command and control of the medical department.

2. The executive officers of the medical staff should be a

   a. Surgeon-General, with the rank of Brigadier-General.
   b. Assistant Surgeon-General, with the rank of Colonel.
   c. Medical Director, with the rank of Lieutenant Colonel.
   d. Surgeon-in-Chief, with the rank of Major.
   e. Medical Purveyor, with the rank of Captain.
   f. Medical Storekeeper, with the rank of Lieutenant.

In whom the executive and administrative powers of the medical department should be vested, as the purchase of hospital supplies and

medical stores, the detailing of medical officers to posts of service, examination of candidates for medical officers, the fixing a standard for such examinations, etc.

3. The duty of Service Corps should be, for each regiment one Surgeon with rank of Major, one Assistant Surgeon and Captain (by promotion and examination from junior assistant surgeon), one Assistant Surgeon with rank of 1st Lieutenant, and for each smaller troop, battalion, battery of artillery, one Captain and Assistant Surgeon and one 1st Lieutenant and assistant Surgeon, according to the number of men and strength of the detail.

4. Each Brigade, consisting of three or more regiments, should be under the immediate supervision of a Brigade Surgeon, with the rank of Major, who from his close relations to the surgeons detailed on duty with the troops, battalion or regiment, can recommend the changes of posts and assume the inspection of the sanitary condition of his command.

5. Two or more Brigades, constituting a Division, should be in charge of a Surgeon-in-Chief with rank of Major; he shall receive the reports of the brigade surgeons of his division, and should be responsible for the sanitary condition of the division in his charge, recommend the best mode of transportation of sick and injured, and be chief surgeon of Brigade Hospital.

6. Two or more divisions should be in charge of a Medical Director; the duties of the Medical Director are supervising and special, being of the executive staff. He is to receive the reports from all senior medical officers, see that hospitals are established at suitable places, recommend the best modes of transportation of troops, etc. The requisition of medical officers for supplies must be submitted to him for his approval and examination before issued.

7. The Surgeon-General or Assistant Surgeon-General are to administer to all matters affecting the health of the army, issue instructions to medical officers to preserve health and strength of men; to decide the amount of hospital accommodations to be provided; to direct the mode of treatment of the sick, the prevention of epidemics, etc.

8. The Medical Purveyor shall have charge of purchase of medical stores, hospital supplies, the distribution of drugs, instruments, litters, books, stationery, etc., and he is to have depots at suitable places to supply the requisitions of medical officer for articles appertaining to the hospital department.

9. The Medical Storekeeper shall have the immediate charge of everything belonging to the medical department, such as all hospital supplies, medical stores, litters, ambulances, etc., and keep an exact report of everything on hand, what and where it has been distributed, and furnish periodical reports to the medical director, who in turn sends it to the surgeon-general for permanent hospital records and as a guide to the proper administration of the department.

10. The Surgeon-General shall cause to be created a medical examining board, consisting of the members of the executive staff, as the Medical Director, Surgeon-in-Chief or whoever he may detail from the medical officers of a regiment, troop or brigade, who shall examine all candidates, whether for positions as medical officers, or for promotion, etc.

11. Each regiment, battalion, troop, etc., shall have attached to it a hospital and ambulance corps, as follows: to consist of Litter-bearers, whose duty it shall be to render first aid to the injured, the transportation of the sick and wounded by means of hand-litters and ambulances, etc.

Hospital stewards, to serve as Apothecaries, Head Nurse at hospital, and who assist the Surgeon in keeping records of the department of his command.

Thus we have the complete personnel with their duties of a model medical department of highest standard.

REGULATIONS FOR MEDICAL DEPARTMENT.*

1. The senior medical officer of a post (which may be a regiment, troop or battalion) shall be the chief sanitary officer. He shall instruct the members of the ambulance corps of his command in their respective duties, rendering first aid to the injured, mode of transportation of wounded, litter drill, etc. He may delegate to his subordinates such part of his duties as he may see fit, but will remain responsible for the efficiency of the service.

2. It shall be the duty of the surgeon or assistant surgeons to examine physically all candidates for enlistment into all branches of the military service according to the established rules of the executive medical staff, making a record of all examinations and sending same

*NOTE.—In the preparation of the final part of this paper I have taken the liberty to use Major A. C. Girard's (Surgeon U. S. A.) excellent paper on suggestions and rules for sanitary service, to which I have taken the privilege of adding what I thought of value and omitting as best suited the wants of our National Guard.

to the commandant of the post where enlistment is to be made, and to the senior medical officer.

3. It shall be the duty of the medical staff to advise what form of dress is best adapted to the service in accordance with hygienic and sanitary rules.

4. The surgeon shall give his opinion to the commandant as to drill, gymnastic exercise and marches, so as to preserve the health and strength of his command.

5. He shall at suitable times make a sanitary inspection of the detail to which he may be attached, and in an action (which may be a regiment on duty at an armory in readiness for a call to subdue a riot) to make a personal inspection of every part of the garrison occupied by enlisted men, particularly as to the police of buildings, the proper use of the means of warming and ventilation, sufficiency of lighting, bedding, clothing and personal cleanliness, and report same to the superior officer of the medical staff.

6. He shall keep a record of everything connected officially with the discharge of his duties,in a book to be designated a sanitary diary, in which he shall keep the findings of physical examination of candidates for enlistment, report of sanitary inspections, etc., and a copy of all reports submitted to his superiors.

7. He shall see that the command is properly protected by vaccination, and to that effect on taking medical charge of a post, regiment, troop or detail, examine the medical records of all men under his charge, and do everything to further and preserve the health, strength and comfort of those under his charge.

FIELD SERVICE.

a. On the March.

1. The senior medical officer of a body of troops aggregated under one command shall be the chief sanitary officer.

2. He shall issue, with the approval of the commanding officer, immediately on taking charge, such general instructions to the medical officers of his command as may be applicable to the services in contemplation. He should advise as to the length of marches, halts, etc., and draw up a set of plain rules to be promulgated by the commanding officer, directing them how to manage on the march (if exposed to great heat, cold or long-continued exercise), how to purify water, clean their clothes, etc., if the march is to last some time and if the halts are made for two or more days, issue instructions for ventilating and cleaning tents, regulation of privies, etc. Whenever con-

ditions vary or emergencies arise he shall modify the orders or add to them. He shall make daily inspection to see if these orders are carried out.

3. He shall cause a medical officer to accompany the officer sent forward for selection of camping places, to advise on the medical topography and assignments of the various parts of the command.

4. If the command shall exceed a regiment, the brigade surgeon should have charge of the details. If that command is made up of a number of brigades the surgeon-in-chief should have charge of the division.

5. The regimental officers should cause all men with sore feet to report before starting on the march; see that the men carry their kits, neither more nor less (when they have to carry them); that the canteens are filled on starting out; that they have their breakfast; they should cause orders to be issued prohibiting the removal of clothing to prevent chilling at the end of the march, and clothes not to be changed sooner than an hour afterwards. They should cause all footsore and sick men to report themselves at once.

In all other sanitary matters if the command be a regiment or less the rules of Par. 1 and 2 will govern.

SANITARY SERVICE IN CAMP.

1. The senior medical officer detailed on duty shall see to it that everything is in proper hygienic accord, "to see that the greatest amount of order, ventilation, cleanness and salubrity is obtained," distance between tents, etc., are all in accord with the rules and regulations formulated by the executive medical staff.

2. He shall see that privies are located at a sufficient distance from camp, that the pits are dug "20 to 50 feet long, according to size of camp, 10 feet deep," 2 feet wide at the top and 3 feet at the bottom in "standing" camps; and in camps for a few days a trench from 10 to 25 feet long, 2 feet deep and 2 feet wide at the top and 1 at the bottom, and that the contents be covered every day with several inches of earth. (The former when (4) four feet from the surface of the ground should be filled up); also that a urinal draining into the pit be constructed.

3. If a command be hutted he shall see that proper regard is shown to ventilation and drainage.

4. He shall advise as to location of slaughtering pens and see that proper disposition is made of offal by burying; also the removal and burial of dead animals.

5. He shall, with the commissary officer, examine beef purchased on the hoof and recommend the exclusion of animals unfit for beef.

6. He shall see that the water supply is carefully protected from contamination; that, if a command is camped on a running stream, the proper sanitary rules are enforced as to the method of obtaining water for drinking, washing and watering purposes, location of bathing places, etc.

7. He shall make daily inspection of the food as issued and as cooked, advise as to the proper methods of preparing food and the proper disposition of refuse matter.

TRANSPORTATION OF TROOPS.

1. In transportation by rail the senior medical officers shall see that each car containing troops is provided with a full water barrel at each end (safely covered) and that the barrels are refilled whenever convenient; that the cars containing troops are properly ventilated and heated, and that overcrowding is prevented, if possible.

2. In transportation by water he shall make careful sanitary inspection of vessels destined for the purpose; as to water supply, capacity, facilities for privies and washing, ventilation, cooking arrangements, means of disinfection, and make a report thereon to the officer in command before embarkation.

3. During the voyage he shall make daily inspection of every part of the vessels to detect and report lack of cleanliness of men, insufficient police, nuisances, insufficient water supply, inefficient cooking. He shall watch for epidemic diseases, immediately report their appearance and advise as to the best methods of isolation, disinfection and other preventive measures. On long journeys he will make careful investigation to detect scurvy at the earliest moment and to advise the use of antiscrobutics.

EPIDEMICS.

1. On occurrence of epidemic diseases in any camp, garrison or command, the medical officer attending a case shall at once report it to the senior medical officer, who will make careful inquiry into its history and predisposing causes and make a report in writing to the commanding officer, recommending the proper measures to be taken, especially regarding isolation, prevention of crowding, whitewashing of infected localities, destruction of infected articles, removal of garbage, disinfection of privies, urinals, sinks and drains, condition of ventilating appliances, the water supply, proper cooking of rations,

avoidance of unripe or decomposing vegetables and fruit, reduction of duty, protection from wet, daily airing of bedding, health exercise and amusements, the prevention of intemperance, moving of camp, etc.

2. He shall submit instructions for the guidance of company officers to facilitate prompt detection of cases, for first aid, for removal or disinfection in their respective commands.

3. In case of cholera, yellow fever or small-pox he shall apply for a special military detail of troops of the lines under charge of a commissioned officer, whose duty shall be the disinfection of infected localities, sannitary police of the camp, prevention of nuisances of any kind, the removal of sick, the burial of the dead, the destruction of infected clothing, etc.

CAMP COOKING STOVES.

By George H. Halberstadt,

First Lieutenant and Assistant Surgeon, National Guard, Pennsylvania.

Mr. President and fellow members of the Association of Military Surgeons:

Gentlemen.—The necessity of a proper cooking apparatus for the use of each company in the National Guard of Pennsylvania has long been recognized.

The following reports cover the ground so thoroughly that they are reproduced verbatim:

Surgeon General Reed in his report of 1888, and repeated in 1892, says: "I wish to direct your attention particularly to the very limited facilities of many of the companies of the division for cooking, furnishing and taking care of food. The daily ration furnished by the commissary department was ample and of good quality, and when properly taken care of and prepared by the company cook gave entire satisfaction. Many of the companies were without kitchens, and in a number the rations on hand were kept in a company tent in which the attendant slept. But the most objectionable feature was the limited facilities of many of the companies for preparing and furnishing the food in a condition palatable, easy of digestion and assimilation. Some of the companies have galvanized iron ovens, very complete, not expensive and easily transported. A number of others have large cook stoves, very complete but difficult to transport. A number of others have stoves of obsolete pattern, and furnish almost everything fried.

The remainder resorted to a most primitive style, by making excavations in the ground three or four feet long, two feet wide and probably eighteen inches deep. These were covered with iron frames or perforated boiler iron. There was no protection over these cooking appliances, and the cooks complained very much and said that it was impossible to prepare food properly.

This is a subject of great and grave importance for promoting the health of the men and maintaining the efficiency of the National Guard. Surgeon Jos. R. Smith, United States Army, in his paper read recently before the Ninth International Medical Congress in Washington, "on the Best Ration for the Soldier" said: "Fuel in relation to the steam engine and food in relation to man are largely analagous; food the fuel, and man the machine." Food is of little service when so prepared that the digestive apparatus can not appropriate or utilize it. The results from it would be as negative as attempting to produce steam from non-combustible material. I would respectfully suggest that a commission be appointed to select or decide upon a pattern of a stove or oven that would meet all the requirements of preparing food in its most desirable and palatable form, and one easy of transportation, and that the Quartermaster-General be directed to furnish one to each of the companies.

Major W. H. Egle, Surgeon Third Brigade, in his report of 1889 says: "The rations furnished were uniformly good, of full quantity, and save in two or three instances, well cooked. Many of the companies lacked good cooks, while others did their cooking in the most primitive style." These subjects are worthy the attention of the different commanding officers of the National Guard. We live in a era of progress and of advanced ideas, and it is all wrong, therefore, to do cooking as did the scouts in the French and Indian war one hundred and thirty years ago.

In 1891, Quartermaster-General Greenland, the present Adjutant-General of Pennsylvania, speaks of the subject as follows: "The time has now arrived, in my judgment, when the State should furnish each company in the guard with a cook stove and utensils. The stoves now in use are of every imaginable design and size, and in many instances are unsuitable for the use intended, causing a great deal of annoyance and unnecessary trouble to the men in preparing food, besides in many instances necessitating a destructive waste of fuel and provisions. Many of them are heavy and unwieldly, and are difficult to transport, and I would respectfully suggest that a commission be appointed to select and decide upon a pattern of a stove or oven

hat would meet all the requirements of preparing food in its most desirable and palatable form, and one easy of transportation, and that the Quartermaster-General be directed to furnish one to each of the companies.

These recommendations during the past five years have caused commissions to be convened, usually while in camp, and after viewing all the cooking apparatus in use have resolved that "a stove was a necessity," and then adjourned to meet at the call of the chairman.

The ration of Pennsylvania is substantially that of the United States Army, and consists of fresh and smoked meats, potatoes, beans, corn, rice, hominy, coffee, sugar, pepper, salt, and hard and soft bread.

In consequence of the failure to possess the proper cooking-stoves, one of the most disagreeable duties of the medical officer was the inspection of the prepared food for the men. Beef that should have been roasted was thrown in the camp-kettle and the first product given to the men as soup. The boiling process was continued until the meat had the appearance of a mass of shoe strings, and it was the most uninviting thing that could be placed on the table. Vegetables were badly cooked, and as a consequence a large portion of food was wasted.

At the school for officers of the 4th Regiment, held in Reading last January, this subject was brought up for discussion. The captains were all urged to provide their companies with a proper stove with oven, but it was discovered that no suitable apparatus was in existence. A committee was then appointed by Col. David Brainard Case to devise a stove.

As chairman of the committee I engaged the services of James Shrader, boiler inspector of P. & R. and C. & I. Co., who is also an enlisted man in the 3d Brigade Band, and Geo. Schimpf, a boiler manufacturer.

After several months of thought and experimentation a stove was evolved. This was given a practical inspection by Adjt.-Gen. Greenland, Surg.-Gen. Reed, Col. Case, Capt. Booth, United States Army, and twenty officers of the several regiments. It proved to be a complete success. Several modifications were made at the suggestion of officers present; the principal one was the reduction in size and weight. The value of this is still questionable. Gen. Greenland had a number of stoves made to be tested by the regiments during the summer encampment. Three of them were in use in our regiment and worked

to the entire satisfaction of the cooks and men. The reports from other regiments have not been received.

The stove at present in use in the 2d Brigade National Guard Pennsylvania weighs 250 pounds and is made of $\frac{1}{8}$-inch boiler iron. It measures 32 inches long, 26 inches wide and 24 inches high. The oven is 16x18 inches and the fire-place 12x26 inches. The points of the stove are these: Its portability. Handles on the corners render it an easy task for four men to carry it anywhere. In case of necessity, a tent-pole or sapling can be run through handles and four more men lay hold. The oven and fire-place are on opposite sides, which gives the cook the oven and both ends to walk about without having to cross the projecting sticks of fire-wood. The door of the oven opens down, with a dependent foot, which makes a table on which to draw out the pans. The oven is large enough to roast 35 pounds of meat at once. The fire-place is lined and has an air space. The inner plates can easily be replaced. The outer plates are perforated to protect them from the heat and to increase the draft. In shipment, the stove-pipe, lids, and all cooking utensils are carried in the oven, camp-kettles in the fire-place. In the first place it was intended to make the stove so as it could be taken to pieces, but every one who has had any experience in setting up a stove after it has been in use for several years, appreciates the difficulty in making the holes meet, not to speak of the constant loss of bolts, nuts and rods.

And now, gentlemen, in conclusion, let me impress the importance of this subject upon you. Let me urge you to carefully examine this model, and if you have any suggestions to make they will be thankfully received. If you can improve upon it, it is your duty to do so, and give the men under your care the benefit of the best food in order that they may attain the highest degree of efficiency.

Colonel Irwin expressed the desire to remain on the list of honorary members as well as active members, and on motion his request was complied with unanimously.

Professor Finkler extended a courteous invitation to all members of the Association to visit and inspect, this afternoon, the Medical Department of the German Exhibit, which would be found on the second floor of the Manufacturers' Building, western entrance. In this department he would take pleasure in explaining and exhibiting the cultures and apparatuses of Koch's Laboratory.

On motion of Major Barkwell, the thanks of the Association were tendered to Professor Finkler, and all expressed a willingness to accept his invitation.

On motion of Lieutenant Clark:

Resolved, That a unanimous vote of thanks be extended to the members of the Association of Military Surgeons of Illinois National Guard, to President Senn and all other good citizens who have contributed to make the third annual meeting of the Association of Military Surgeons of the United States so pleasant and successful.

Adopted.

President Senn, in accordance with custom, announced the various committees for 1893 and 1894 as follows:

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Chairman Local Committee of Arrangements.

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On motion of Colonel Woodward, which prevailed, the Association adjourned to convene first Tuesday in May, 1894, at Washington, D. C.

E. Chouellon,

Secretary.

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REVISED TO INCLUDE JAN. 31, 1894.

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Greenleaf, Chas. R., lt. col. dep. surg. gen. U. S. A.36 New Montgomery, San Francisco, Cal

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* Deceased.

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THE ASSOCIATION OF

Military Surgeons of the United States.

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Write Name in full.

Rank, ...

Regiment, ... Brigade, ...

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Elected to Membership, ... 189.....

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Secretary.

A—Active Member.

B—Honorary Member.

C—Contributing Member.

[OVER.]

(Extract from Constitution and By-laws, adopted August 9th, 1893.)

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This Association shall be composed of Active, Honorary and Contributing Members.

A.—Active Members.

Active Members shall consist of any commissioned Medical Officers of the U. S. Army, Navy, Marine Hospital Service, and National Guard or Volunteer Militia of the United States.

On application and presentation of the proper credentials to the Secretary of the Association, and on payment of the entrance fee, they may become Active Members of this Association, and shall retain their membership and rank, should they be honorably discharged from the service in which they were commissioned, and entitled to wear the uniform of the rank held at the time of discharge from the service, upon payment of their annual dues.

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B.—Honorary Members.

Honorary Members shall consist of men who have been in the Medical Service of the National Guard, or in the Medical Department of the Regular Army or Navy and Marine Hospital Service, or in that of the National Homes for Disabled Volunteers, or any distinguished Military or Naval Surgeons from any part of the world, who from time to time may be unanimously elected. The names of persons nominated for this honor shall be referred to the Executive Committee on the first day of the annual meeting before they are balloted upon. They shall be entitled to all the privileges of Active Members, except to the holding of office and voting.

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Secretary.

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[OVER.]

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